The Electrical Industry's Weekly Magazine

August 21, 1961

Electrical World

Price 50 Cents

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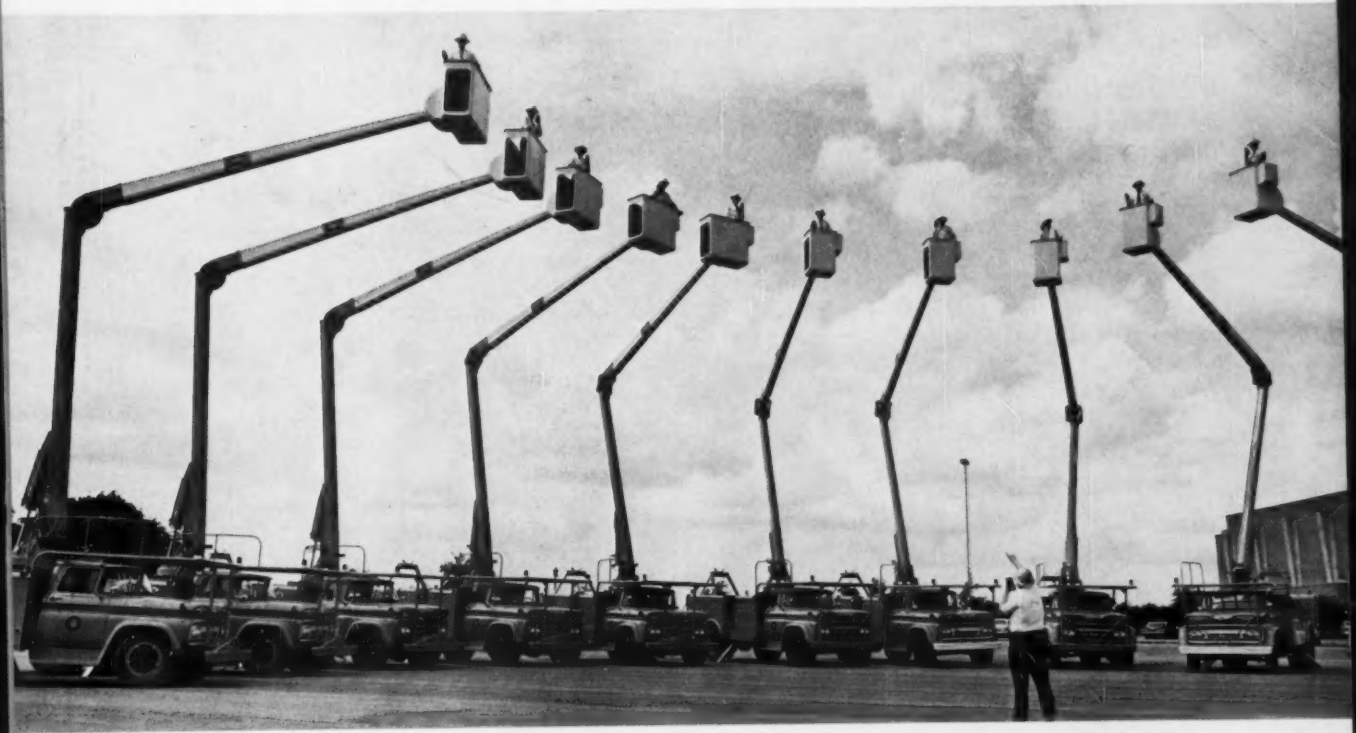

Consumers Power Doubles Aerial Basket Fleet ...p 48

UNIV MICROFILMS INC
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Featuring ALUMINUM STRIP Low Voltage Windings

***DS-50 — Delta-Star's new design with minimum short-circuit capability of 50 times rated current**

Delta-Star offers utilities a totally new concept in Distribution Transformers with the introduction of Aluminum Strip Low Voltage Windings and the New Porter Core. These advances, added to previous Porter contributions to electrical distribution economy, provide the *finest line of Distribution Transformers made.*

Here's what the Aluminum Strip Winding gives you:

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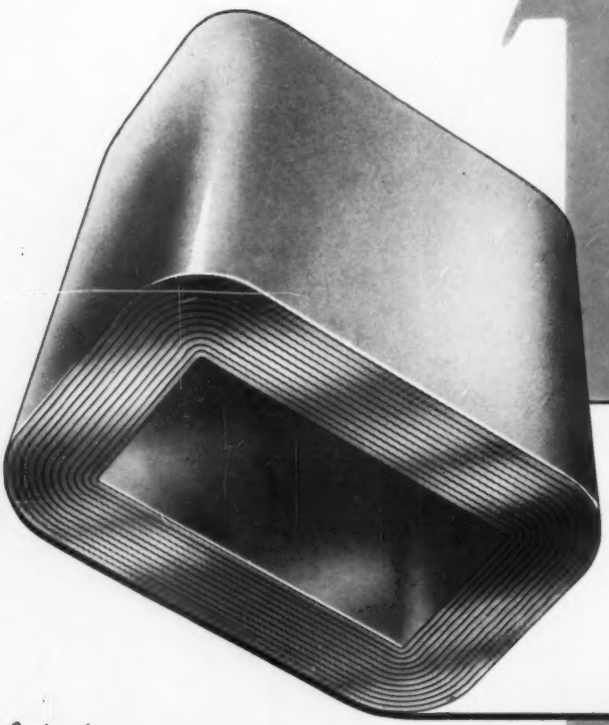

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Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

August 21, 1961
Vol. 156, No. 8

Dateline . . .

Premier Bennett and His New Power Company

Vancouver, B. C.—United States citizens, who are accustomed to considering Canadian institutions as virtually identical with their own, should be somewhat puzzled by the ease with which British Columbia Premier W. A. C. Bennett conjured away the property of the British Columbia Electric Co (EW, Aug. 14, p 64).

Not only did he, by flashing a bill through a friendly legislature, make the task appear ridiculously easy, but he also seemed to have the approval of a good portion of the electorate. And further, he seems to have retained the reputation of being the champion of free enterprise in the province.

Regardless of the merits of public vs private power, most governmental officials who would dare to attempt such a cavalier takeover of any smoothly running corporation in the US would be the target of an irate citizenry. Where, then, does Premier Bennett get his political persuasion pills from?

He really doesn't need any. The British North American Act of 1867 gives provinces of Canada firm control over all civil and property rights within their boundaries. This provision gives states-rights advocates a fortress that their counterparts in the US can only envy. And it gives Bennett a position in the US-Canada treaty for development of the Columbia River far more powerful than that of any state governor in the US.

None of this bothers British Columbia citizens. First of all, better than half of Canada receives its power from some agency of government, and power questions don't spark the excitement that they often do in the U.S. Second, the British Columbia provincial government is already in business in a big way, and the new takeover appears to many as a logical next step toward government operation of all necessary transportation and utility functions. Bennett's government took over ferry service to Vancouver Island about a year ago, and the operation has been a popular success. Third, British Columbia badly needs an economic shot in the arm, and Bennett's ambitious scheme for development of the Peace River is massive enough to provide momentum—if

(*Continued on page 5*)

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"Announcement by Lapp of its **Hi-F** *suspension insulator is typical of the opportunity we seek. We believe that no standard is too sacred to exempt it from close scrutiny in the interests of reducing costs and improving efficiency under changing operating requirements."*

Lapp **Hi-F** is a suspension insulator designed to produce characteristics more nearly in line with ratings—and requirements. It is "non-standard" only in its 9" diameter, and in its strength rating—14,000 lbs. M&E. Otherwise it matches in mechanical ratings—and electrical characteristics—the 10" NEMA standard 15,000 suspension insulator (and is physically interchangeable with all "standard" suspension insulators). It weighs one-third less, so costs less to handle in the field and is simpler for hot-line work. For any installation at working load handling up to 7,000 lbs., Lapp **Hi-F** offers a new standard of economy, ease and efficiency. Look into it!

Lapp Insulator Co., Inc., LeRoy, N. Y.

Electrical World

Dateline . . .

Vancouver, B. C. (*Continued from page* 3)
it gets off the ground.

Bennett has firm control over the 32 seats which his Social Credit party holds in the 52-seat Legislative Assembly, so there never was any question of his receiving an assembly rebuff on the seizure. Indeed, the left-wing Cooperative Commonwealth Federation, holding second-high position with 16 seats, has long carried on expropriation plank as an indispensable part of its party platform, and it could only grumble while going along with Bennett.

With the domestic political scene quiescent, then, Bennett is free to let Ottawa worry about the treaty while he concentrates on developing the British Columbia economy and, on the side, trying to sell power south of the border—power that he feels certain Ottawa must decide to let him export.

So Ottawa sits with a treaty which critics had already cited as being overly generous to the US, and over which Premier Bennett now holds a virtual veto power. Justice Minister Davie Fulton, who has carried the Ottawa lance in this states-rights tilt, called Bennett's move an "economic disaster."

More than roses lies in Bennett's path. The investment climate in British Columbia has been badly shaken by the expropriation, with investors asking the obvious, "Will we be next?" And Bennett can't afford to anger the financial community, not only because of the need for additional investment, but also because he will be around to see them when he starts adding up the estimates for the development of the Peace.

For the US Pacific Northwest, the outlook has not cleared appreciably. Ottawa thinks Bennett can't meet a good price below the border. Bennett, obviously, thinks otherwise. The market for power costing about what Bennett is hoping for—three and a half to four mills—is mainly in California. It's still open to debate whether any of it will get there.

Letters

Power Policy Stand Is Challenged

To the Editor:

I regret the necessity for repeated "letters to the editor," but see no alternative in view of the frequency of your unjustified attacks on the Assn and on aspects of the public power program.

Your editorial of June 19 seems to reflect a view that all proposed federal power projects are bad *per se*. Thus, you regard the President's request for further study of the Passamaquoddy tidal project as hostile to the privately owned segment of the power industry. It is a simple matter of fact that aspects of the IJC report are open to legitimate question, particularly in the light of the differences between the IJC report and the Engineering Board's report. Whether these are the reasons for the President's action, I have no idea, of course, but it does seem to me that the President has every right to request further review of the project even though the editor of *Electrical World* regards it as "pathetic." Why this decision should be regarded by the private power companies as a hostile act baffles me. No private interest has proposed to develop the 'Quoddy tides and if the federal government were to develop them it would appear that most of the power probably would end up in the hands of private power companies.

World exhibits the same negative attitude towards power facilities for the Hanford reactor. In an earlier editorial, you angrily denounced the idea because it is the federal government which proposes to convert to useful electricity the huge amounts of heat the reactor will produce. Apparently, you strongly prefer that it be totally wasted. Here, again, it appears that most of the power will go to private industries and privately owned utilities for at least ten years.

Actions taken recently by the Administration in connection with the Passamaquoddy report and the Hanford reactor seem to me to represent commendable efforts to make sure our country makes optimum use of the natural resources it has at hand. To interpret them as "callous" and devoid of logic and to say they indicate that the private power companies face "once again a "battle for survival," as your editorial does, seems hysterical and demagogic.

I gather that *Electrical World* opposes the development or use of power resources by the federal govern-

(*Continued on page* 90)

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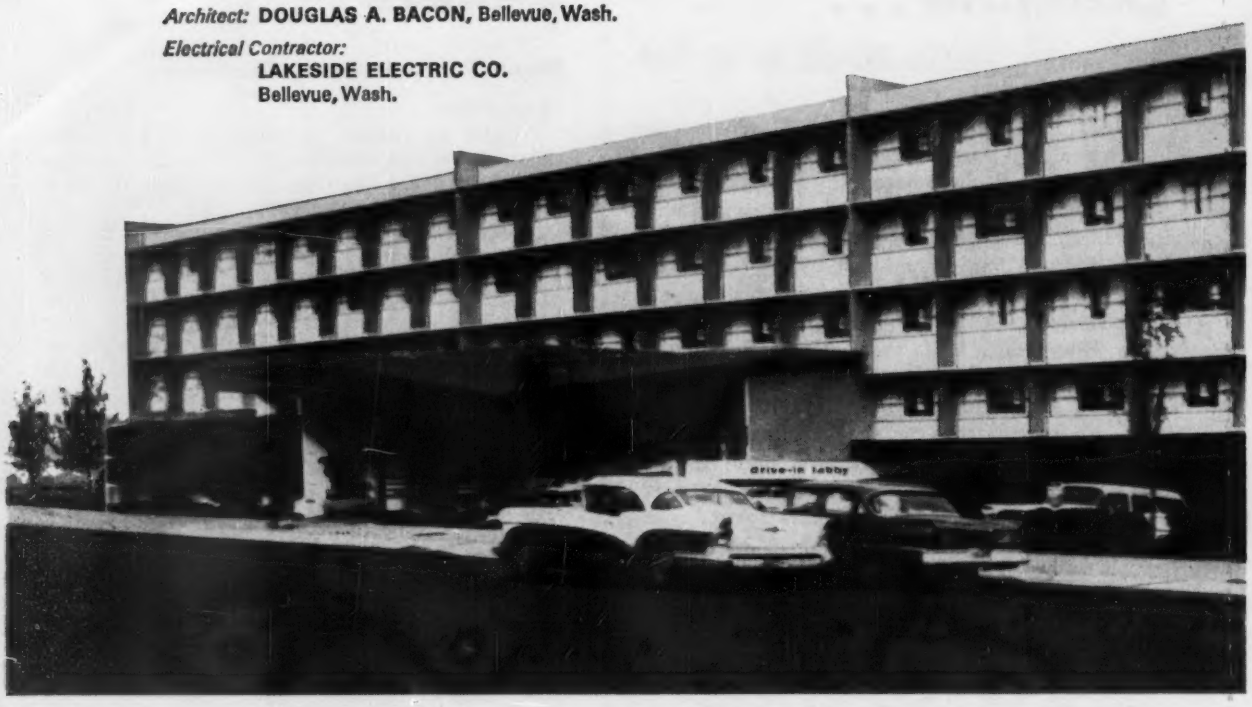

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at the Doric 6th. Avenue Motor Hotel, Seattle, Wash.

Travelers staying at this new, luxurious 175 unit motor hotel enjoy the latest conveniences of electrical living. Even the rooms are heated electrically so each person may select the room temperature he prefers.

These modern services require large electrical capacity. As a result, the available fault current is approximately 70,000 amperes.

Safe protection against faults of this magnitude is assured by the BUSS Hi-Cap fuses installed in the main entrance service. These fuses have an interrupting rating of 200,000 amperes rms. symmetrical.

To maintain safe, modern protection throughout the electrical system,—and to safeguard against unnecessary interruptions in electrical service, FUSETRON dual-element fuses are installed in the branch circuit switches.

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION

861

There is a safe, modern BUSS or FUSETRON fuse with specific characteristics to match your requirements.

Available from BUSS: High interrupting capacity fuses to protect against fault currents up to 200,000 amperes; current-limiting fuses to restrict let-thru fault currents to safe values; long time-lag (dual-element) fuses to prevent needless outages on harmless overloads.

And with Fuses safe protection remains safe. BUSS and FUSETRON fuses are just as safe and accurate 20 years or longer after installation as on the day installed. Dust, fumes, corrosion or age cannot prevent them from opening when they should.

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Mr. S. Andrew Sharpe, Manager of Lakeside Electric Co., at main switchboard of Doric Motor Hotel.

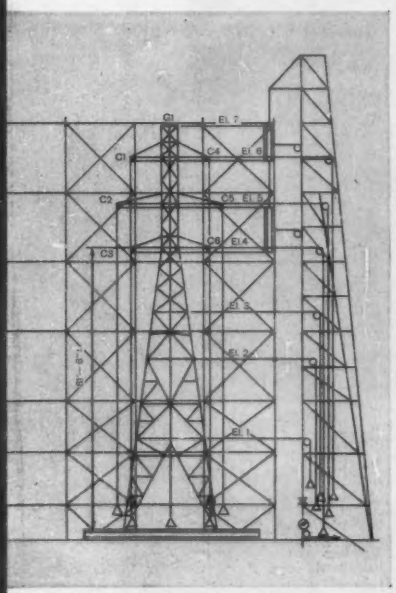
Mains and feeders protected with BUSS Hi-Cap fuses. Branch circuits protected by FUSETRON dual-element fuses.

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.* **ST. LOUIS 7, MO.**

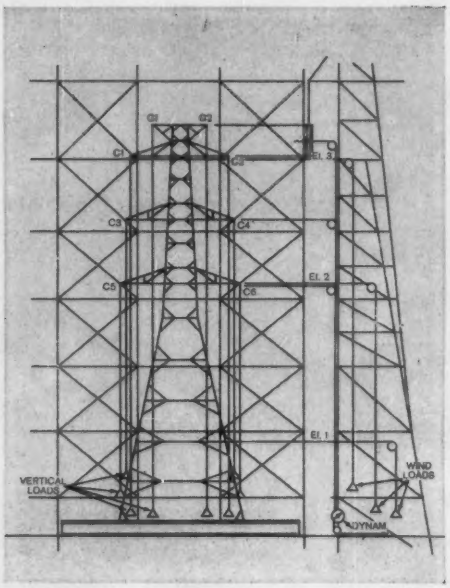
To prove out new designs . . . American Bridge tests full-scale transmission towers to destruction

Who knows for sure what a hurricane or heavy ice loads will do to a new type of transmission line? To help find the answers to these and other questions, American Bridge has maintained for over 30 years the world's largest tower test frame at its Shiffler Plant in Pittsburgh, Pa.

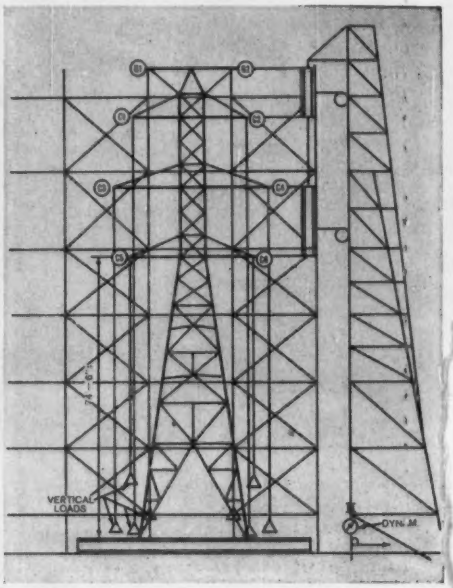
New tower designs and how they are tested by American Bridge



Suspension Tower, American Electric Power Service Corp. This test of a very light 138-KV tower was made to prove that such structures can be designed and fabricated of steel and marketed in competition with competitive materials. The design was extremely light, and the quantity of towers required was sufficient to warrant a test which proved the tower strength.



Double circuit suspension tower, West Penn Power Company. West Penn Power design engineers designed the pictured structure to solve some of their future transmission line problems. This was an extremely unique design using the Vierendeel truss concept, to our knowledge for the first time in transmission towers. The tower passed the required load tests and is soon to be in service for the West Penn Power Co.



230-KV Tower, Public Service Company of Indiana, Inc., Sargent & Lundy, Engineers. Sargent & Lundy designed this rectangular base, double circuit tower to be economical in the use of steel and thus lower costs. The large number of towers justified many design refinements, and the tests proved the lightweight tower exceeded requirements by an adequate margin.

Vertical loads are applied by suspended trays, loaded with steel plates, and attached to the flexible hanger brackets on the conductor crossarms, and to the U-bolt on the ground wire peak. These trays are raised and lowered manually and independently by chain blocks.

Wind loads are also applied with suspended trays loaded with steel plates with lines attached at various elevations, usually six. These loads are transmitted to the tower through strain plates at the ends of the conductor crossarms and by tying the cable around the tower legs. Wind load at the ground wire peak is included as a portion of the transverse load.

Transverse loads are applied by a screw mechanism and measured by a dynamometer connected in series. These loads are transmitted to the conductor crossarms through the flexible hanger brackets, and to the ground wire peak through a strain plate.

Longitudinal loads are applied by a screw mechanism and measured by a dynamometer connected in series. These loads are transmitted to the conductor crossarms through the flexible hanger brackets, and to the ground wire peak through the U-bolt.

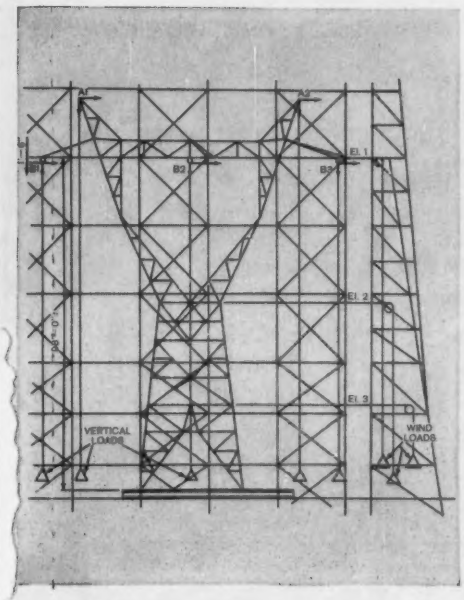
Deflection readings are taken at the ground wire peak, and at the bottom crossarm, in both longitudinal and transverse faces.

Different towers require some changes in these setups but generally the methods are similar for all tests.

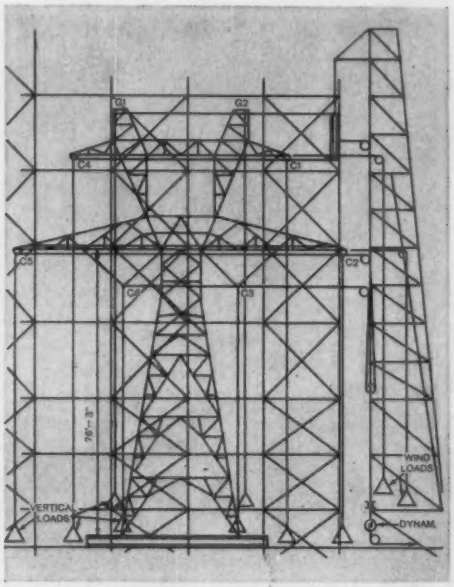
Testing is generally confined to transmission tower structures which are to be used in great numbers. Although testing a full-scale structure is naturally an added expense to the line, the tests pay for themselves in proving that economical, lightweight structures can be made to do the required job. Any combination of loading conceived by the engineers can be applied simultaneously with these test facilities.

With the use of higher voltages and bundled conductors, tower designs in recent years have gone through many changes. Our test facilities are available to the electrical industry to prove out any new ideas.

This mark tells you a product is made of modern, dependable Steel.



460-KV Tower, Tennessee Valley Authority. This 460-KV single circuit structure was the largest tower of its type ever to be tested. The Tennessee Valley Authority is now constructing a section of 460-KV using these structures and intends to make further use of this type of structure in future transmission lines.



Suspension Tower Type 2A, Ohio Edison Company, Commonwealth Associates, Inc., Engineers. Commonwealth Associates, Inc., designed the unique delta-type, double-circuit 345-KV structure. Because of many innovations in design and its extreme light weight, the tower was tested to determine if the structure was adequate for the design loads.

American Bridge, the world's leading transmission tower specialist, pioneered the use of USS MAN-TEN High Strength Steel with A-7 Carbon Steel to trim a ton or more of dead weight from the average tower. Recently, we designed towers to carry the highest voltages likely to be used for the next decade.

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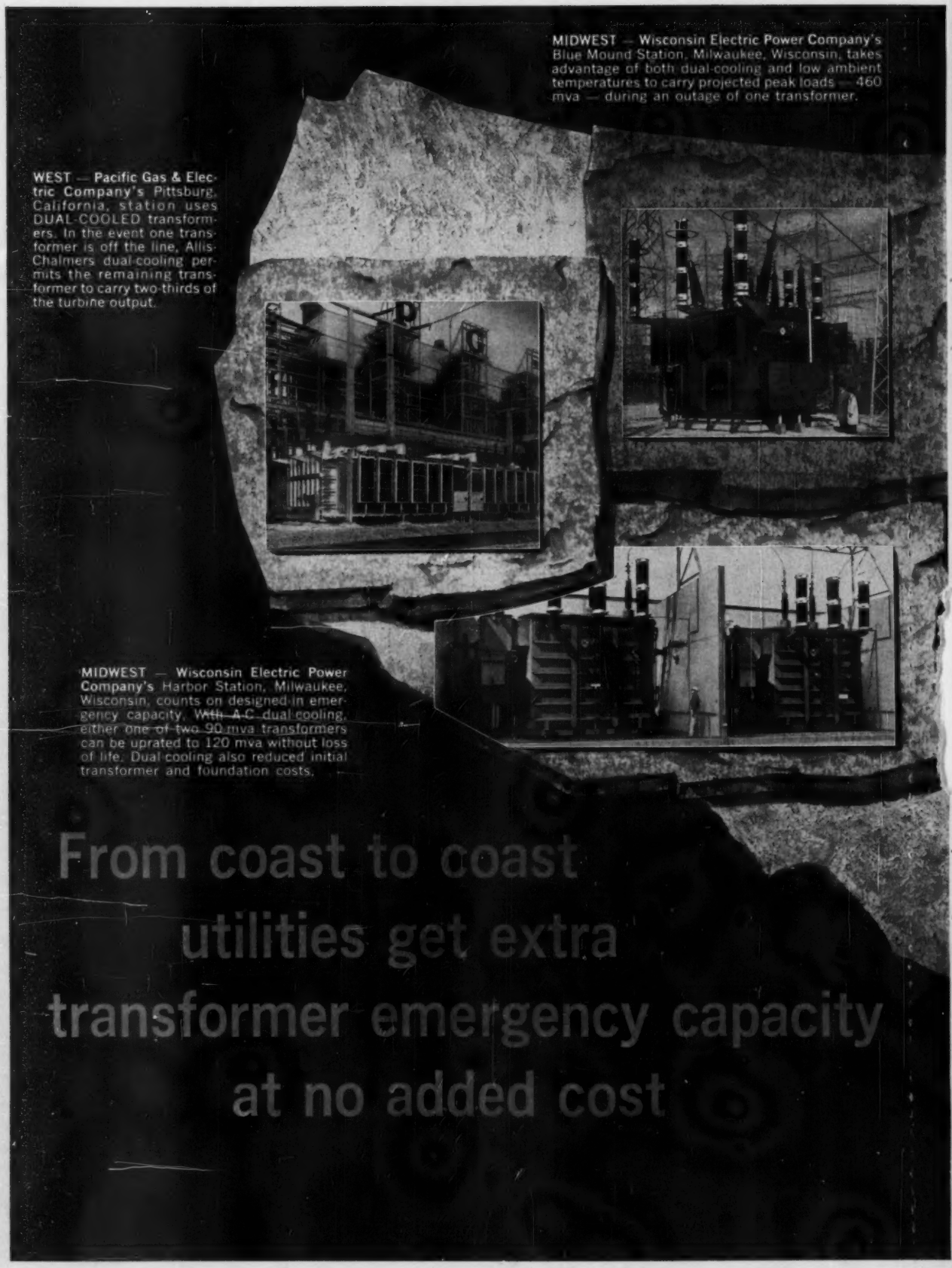


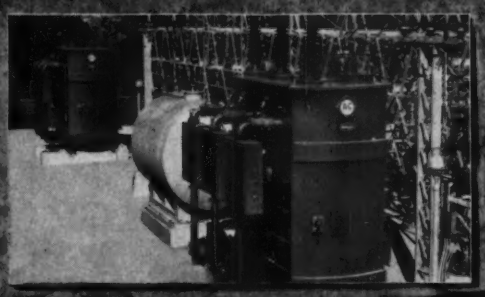
MIDWEST — Wisconsin Electric Power Company's Blue Mound Station, Milwaukee, Wisconsin, takes advantage of both dual-cooling and low ambient temperatures to carry projected peak loads — 460 mva — during an outage of one transformer.

WEST — Pacific Gas & Electric Company's Pittsburg, California, station uses DUAL-COOLED transformers. In the event one transformer is off the line, Allis-Chalmers dual-cooling permits the remaining transformer to carry two-thirds of the turbine output.

MIDWEST — Wisconsin Electric Power Company's Harbor Station, Milwaukee, Wisconsin, counts on designed-in emergency capacity. With A-C dual-cooling, either one of two 90 mva transformers can be uprated to 120 mva without loss of life. Dual-cooling also reduced initial transformer and foundation costs.

From coast to coast utilities get extra transformer emergency capacity at no added cost

EAST — Philadelphia Electric Company's Eddystone Station has twin A-C 200-mva DUAL-COOLED transformers that jointly carry the output of one generator. With inter-connected manifold cooling, one transformer can carry practically the entire load of the generator if the second transformer is out of service.



SOUTH — Gulf Power Company's Bayou Chico Substation, Pensacola, Florida. Previously applied on only larger transformers, A-C dual-cooling offers economies for smaller units too. Here, either of two 20,000-kva DUAL-COOLED transformers can be uprated to 26,667 kva.

DUAL-COOLED transformers boost emergency capacity without loss of life! Throughout the nation more and more utilities are turning to DUAL-COOLED transformers as an economical new way to get central station and substation emergency capacity. DUAL-COOLED transformers—an Allis-Chalmers development—utilize a bank of two or more transformers. During an emergency, while one transformer is off the line, its cooling equipment is connected to the functioning transformers. Result: Capacity of any DUAL-COOLED transformer can be increased over its normal rating. *Dual-Cooled transformers is an Allis-Chalmers trademark.* A-1468

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Choose from three Bethlehem ACSR core wires

Now your conductor manufacturer can supply all three types of Bethlehem ACSR core wire—Bethalume (aluminum-coated), Bethanized (electrolytically zinc-coated), and hot-dip galvanized. Bethlehem can give you a coating and a coating weight to meet virtually every atmospheric condition.

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BR★60

Double side-break switch for heavy duty jobs

The new BR★60 Switch was designed in response to the demand for economical heavy duty switching facilities required by increased loads in utility systems.

Its fundamentally simple design makes the BR★60 at once rugged, economical and easy to operate . . . exceptionally free from binding and the consequent wear and maintenance. The BR★60 has been fully tested in the Hubbard-Kearney laboratory.

BR★60 is the ECONOMICAL answer to many switching requirements . . .

its price is surprisingly low for a heavy duty switch capable of handling:

- Oil circuit breaker by-pass and isolation
- Bus sectionalizing
- Potential transformer disconnect
- Line isolation
- Lightning arrester disconnect

BR★60 Specifications and Features

- Group operated, double break air switch, 3 insulator stacks per pole
- Horizontal blade movement actuated by rotation of center stack
- Voltage ratings of 115, 138 and 161 KV in ampere ratings of 600, 1200, 1600 and 2000 amps.
- One piece blade of hard drawn copper tubing
- Only 2 current interchange points
- High pressure silver to silver contacts with coined silver overlay on stationary contacts
- Rotating stack bearing—stainless steel ball bearings completely weather protected

Reverse loop configuration at contacts utilizes magnetic effect of increasing current to increase contact pressure.

Blade actuating mechanism is simple, powerful and weatherproof, with corrosion resistant bearings.

For full details ask for Bulletin 8-100

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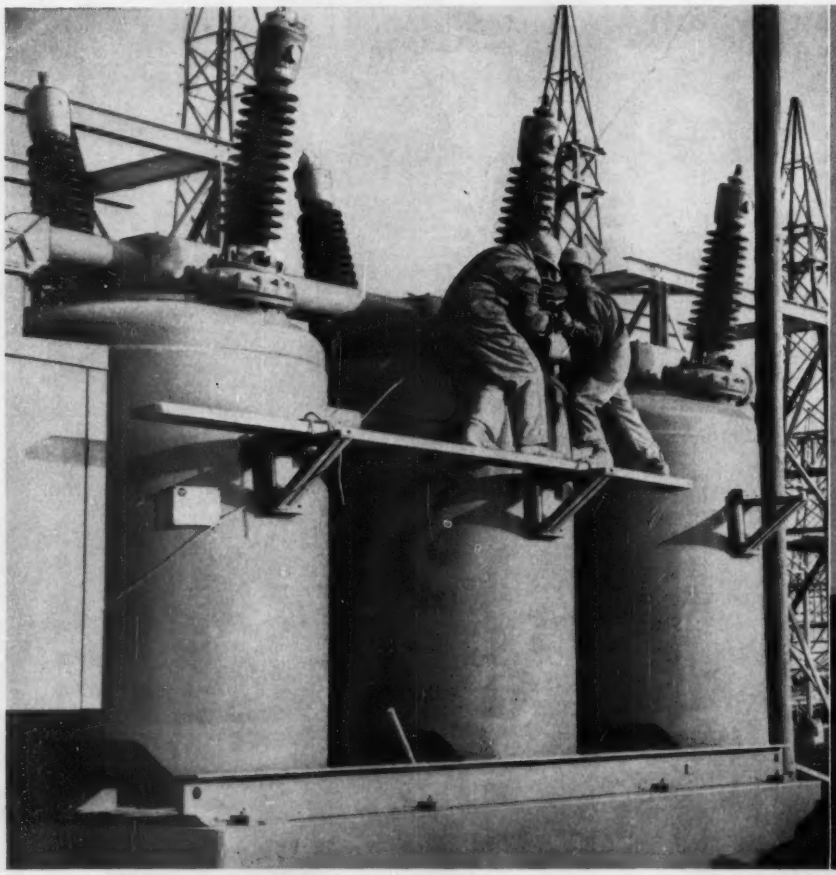
Uses only De Laval Centrifugals for Insulating Oil Purification



At Lewiston:
A 1,200 gal/hr
De Laval Model 84-36
for insulating oil purification
Two 300 gal/hr
De Laval Model 65-36's
for lube oil purification

At Tuscarora:
A 1,200 gal/hr
De Laval Model 84-36
for insulating oil purification
Two 300 gal/hr
De Laval Model 65-36's
for lube oil purification

At the Switchyard:
Two 1,800 gal/hr
De Laval Model 94-36's
for insulating oil purification
A 1,200 gal/hr
De Laval Model 84-36P
for portable
insulating oil purification

These oil circuit breakers are typical of the installations served by the portable De Laval #65-36 Oil Purifier.

Maximum security with minimum maintenance sums up the reason for the 9 De Laval installations at the Niagara Power Project. They remove water and solids quickly, efficiently and continually. All types of oils, including synthetics, are purified without removal of additives.

Centrifugal purifiers or complete centrifugal systems for your power generation or power transmission units are available from De Laval. We can help you in the choice of an optimum system for each application.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York or
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ANOTHER FIRST FROM HOLAN...

So New We Haven't Dressed it Yet

It's ready now — the first center-mounted derrick for the utility field that can be operated from a rotating crow's-nest. All that's left to be done is to sheathe in a famous Holan-built body.

But it has already been subjected to hour after hour of torturous digging and lifting in every position. And it can take it . . . take even the punishment of harnessing the 8,400 pounds of torque of the Holan 5400 Earth Borer.

The center-mounted 7700 erases the blind spots, permits the operator to dig and "live boom" 9,000 pounds . . . rotate 360° in either direction . . . extend and retract the 7-foot boom . . . set 80-foot poles. And he does it all with foot and hand controls . . . and with a safe, unobstructed view of his work area.

The derrick — including the base, superstructure and hydraulic outriggers — is built as an integral unit and can be easily mounted on the chassis at any point behind the cab.

Make it a promise to see this powerful and remarkably versatile derrick with its full range of optional equipment before you buy any center-mounted derrick. Call your Holan Field Representative . . . or write us today . . . for complete information.

HOLAN CORPORATION, 4100 W. 150th St., Cleveland 35, Ohio

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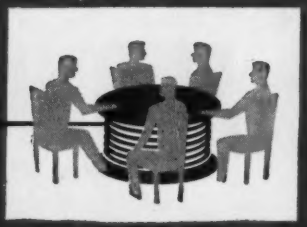
Subsidiary of THE OHIO BRASS COMPANY

HOLAN

DU PONT

WIRE AND CABLE ROUND TABLE



Over 20 years' exposure in Florida sun proves weather resistance of polyethylene for wire jackets

You have asked . . .

Q. Our test results on the dielectric constant and dissipation factor of your ALATHON polyethylene resins do not correlate with your published data. Can you resolve these differences?

A. Possibly our different values are due to a variance in test methods. We normally test the dielectric constant and dissipation factor of ALATHON resins by the benzene cell in our laboratories. Another reliable test uses the guarded-cell method. However, the guarded-cell method consistently gives higher dielectric constant values and slightly lower dissipation factors than the benzene cell. While both methods are ASTM-approved, we prefer the benzene cell despite some of the precautions required in handling benzene.

As an example, we tested five lots of weatherable ALATHON 4, BK-30 by both test methods. Following are the average dielectric constant and dissipation factor results at 10Kc. Please note that the values are for a carbon-filled polyethylene. A natural polyethylene would have superior electrical properties.

	Guarded Cell	Benzene Cell
Dielectric Constant	2.70	2.58
Dissipation Factor	0.0009	0.0012

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.

(UNRETOUCHED PHOTO)

The segment of telephone wire being flexed in the photograph above is part of a Bell Telephone Laboratories test installation which has been exposed for over twenty years to Florida sunlight and weather. The wire, which was jacketed with a weather-resistant polyethylene resin, withstood this prolonged exposure with no significant adverse effect.

Newer formulations of Du Pont ALATHON polyethylene resins have shown over fifty years' weather resistance in accelerated tests. Today, high-molecular-weight polyethylene is the preferred jacketing material of many large utilities and industrial users.

Whether environmental conditions include intense sunlight or repeated exposure to ice and storm, jacketing of ALATHON provides the necessary weather resistance, stress crack resistance and abrasion resistance. Installation is easier, too—because cable jacketed with ALATHON is light, flexible and smooth. It offers you minimum maintenance, maximum service dependability.

For more information about the properties and advantages of wire and cable constructions with insulation and jacketing of ALATHON polyethylene resins, consult your supplier. Or write: Du Pont Company, Dept. EW-821, Room 2507A, Nemours Building, Wilmington 98, Delaware.

• • •

In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.

POLYCHEMICALS DEPARTMENT

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Better Things for Better Living . . . through Chemistry

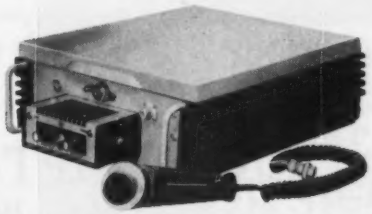
ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

RCA "LD" 2-way radio has the guts to stand up to the toughest jobs!

There are rugged places where men, trucks and 2-way radios have to go, and each has to be a proven, reliable performer. In 2-way radio, this means quality must be built-in to take the gaff—quality such as only the leader in radio and electronics can offer—in the new RCA "LD" (Low battery Drain). Quality and price are combined in this dependable RCA equipment to give you the very best performance at the lowest cost. Use it on the roughest roads—Security Sealed Circuits are your assurance it can take it. Leave the radio on when your vehicle engine is turned off—battery drain is negligible—transistors are used in circuits where they have been proven to be most dependable.

It took experience and daring to bring you today's RCA 2-Way Radios. It meant discarding preconceived notions about circuits and redesigning with transistors in key places for reliability with economy. And it involved engineering a host of other advanced features to assure fine message intelligibility, and long component life at moderate cost.

Your RCA Communications Specialist will be glad to show you why the "LD", dollar for dollar, feature for feature, is today's greatest 2-way radio value. Or send coupon for further facts.



RCA

The Most Trusted Name in Radio

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Telecommunication Center, Dept. YC-45
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☐ Please send me FREE literature on the new RCA Transistorized Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

NAME_____ TITLE_____

COMPANY_____

TYPE OF BUSINESS_____

ADDRESS_____ PHONE_____

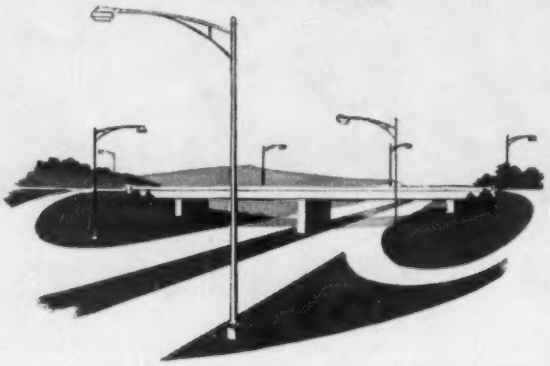
CITY_____ ZONE____ STATE_____

for street lighting • highway lighting • floodlighting

UNION METAL MONOTUBE POLES

Monotube street lighting poles . . . steel or aluminum . . . round or fluted . . . davit or bracket styling . . . anchor or transformer base. Attractive in any location. Continuous-tapered Monotube poles are available in a broad range of designs and sizes to meet all requirements.

Monotube highway lighting poles are offered for various mounting heights and strength requirements. Easily wired and installed. Steel Monotubes are made from high grade, open hearth steel and cold-rolled for strength. Aluminum poles are either cold-rolled or spun.

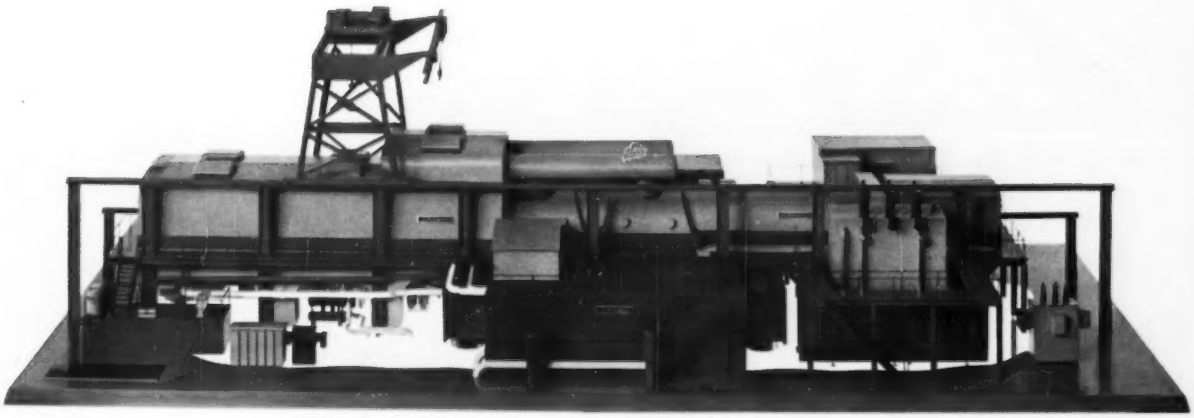


Monotube floodlighting poles . . . for sports, business, industrial or recreational areas. Available in heights from 20 to 100 feet. Monotube designs permit extreme flexibility in arrangement and number of light units per pole. Floodlights can be mounted, positioned and wired while pole is on the ground.

Complete design and specification data is readily available upon request. Write The Union Metal Manufacturing Company, Canton 5, Ohio. In Canada: The Union Metal Manufacturing Company of Canada, Limited, Brampton, Ontario.

UNION METAL

Monotube Lighting Poles



NOW—WESTINGHOUSE
POWER ISLAND
DESIGN PERMITS
REDUCED PLANT
INVESTMENT FOR
100 TO 500 MW
GENERATING UNITS

COMPACT POWER ISLAND COMPONENTS ARE KEY TO LOW FOUNDATION & INSTALLATION COSTS

The Power Island concept which Westinghouse helped pioneer in cooperation with Texas Electric Service Company offers an opportunity to make substantial savings on power plant costs wherever it can be applied. Power Islands contain turbine generator, heat transfer apparatus, switchgear, power transformer and associated control equipment—all engineered as a package. The result is an extremely compact assembly of apparatus arranged to minimize necessary piping and wiring, and to eliminate bus work. What is more, Westinghouse produces more "island" equipment than any other single manufacturer and is in the best position to integrate components to produce lowest cost.

SAVINGS ARE TANGIBLE

The Power Island can reduce plant investment by:

- Permitting completely above grade installation.
- Minimizing foundation requirements through use of tandem-compound turbine.
- Reducing piping, valving, conduit and wiring.
- Combining equipment such as main and auxiliary power transformers in a single tank.
- Elimination of low-voltage isolated phase bus.

Arrangement of the Westinghouse Power Island is ideally suited to outdoor installations with savings in building costs. Even where shelter is necessary, efficient layout will permit reduction in overall plant size and crane span.

POWER ISLAND DESIGN FLEXIBILITY ASSURES MOST EFFICIENT HEAT CYCLE

The Power Island concept assures integrated layout and design for both turbine and heat transfer apparatus. The heat cycle can be optimized within the framework of your operating specifications.

Next, the integrated Power Island design lends itself perfectly to full automation using the Westinghouse PRODAC®-IV digital control computer. PRODAC-IV can operate equipment directly during startup, operating and shutdown sequences —as well as perform computing, data logging, scanning and alarm functions to aid personnel in safe, reliable and efficient plant operations under all conditions.

Finally, Westinghouse maintains steam division representatives in all major cities who will be glad to discuss the application of the Power Island design to generating facilities you have planned. These men are able to evaluate your information to make sure that any final proposal is complete.

For further information on the Westinghouse Power Island design, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

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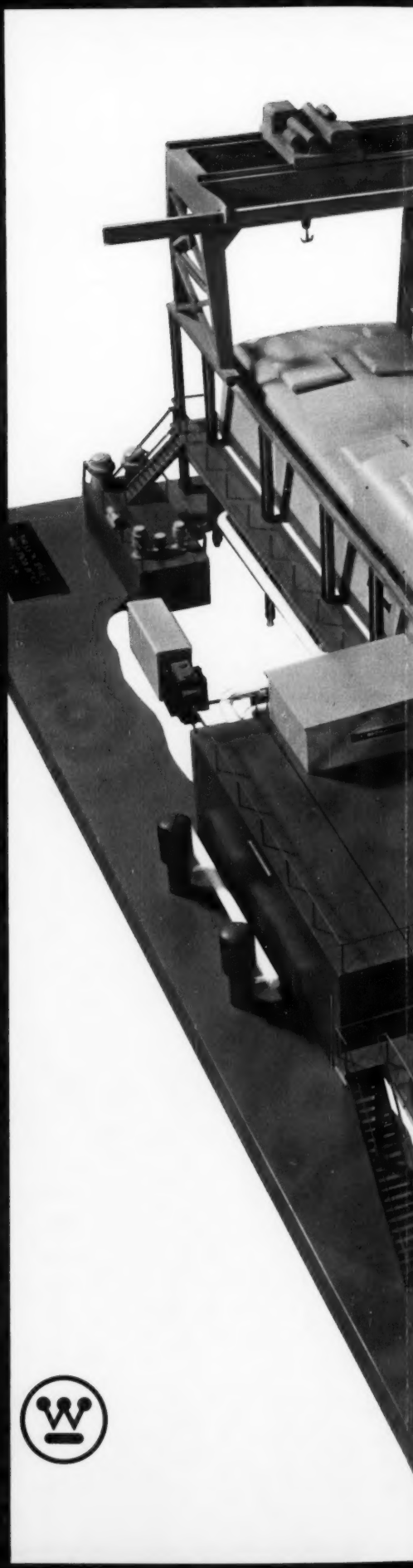
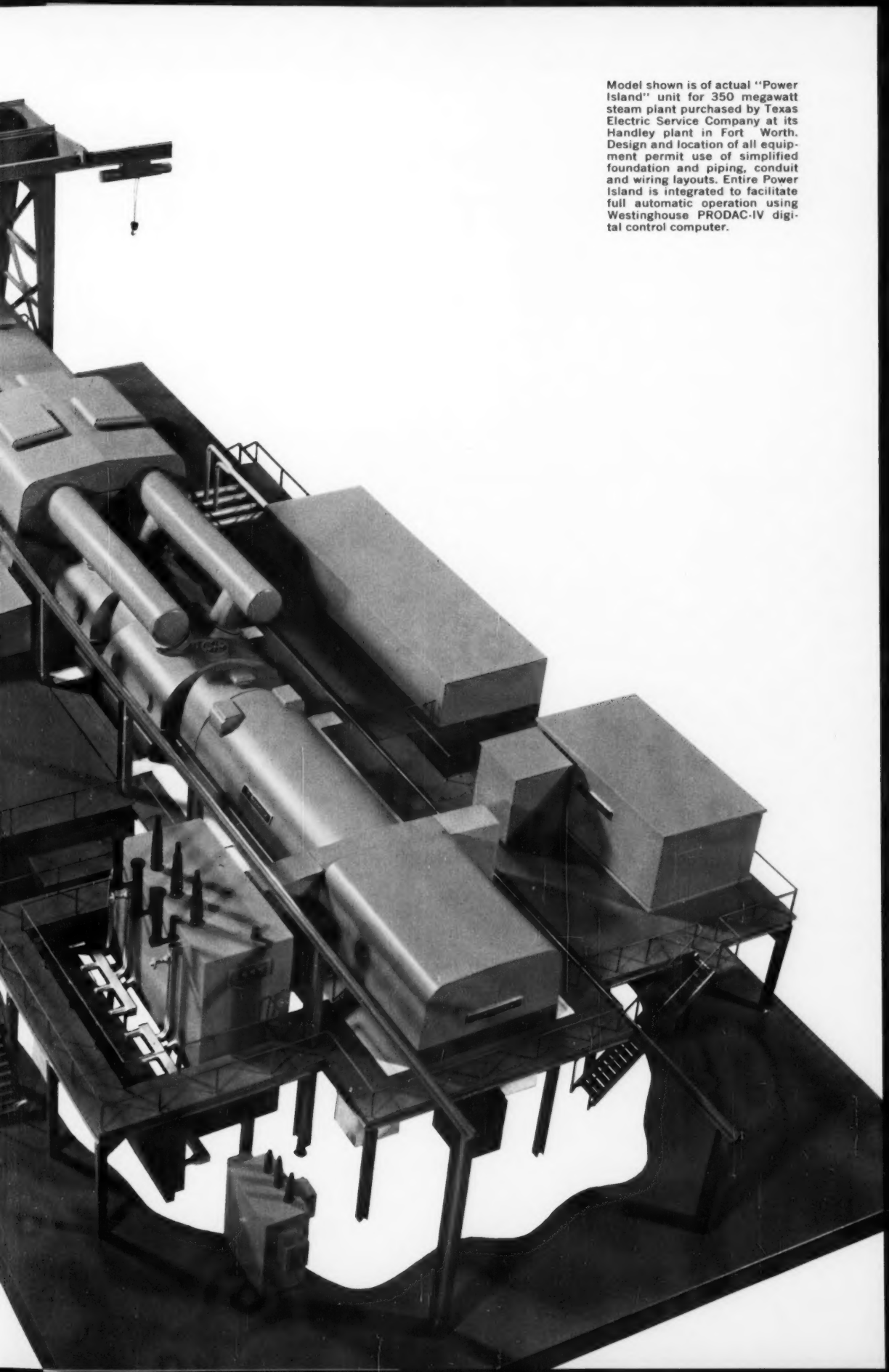
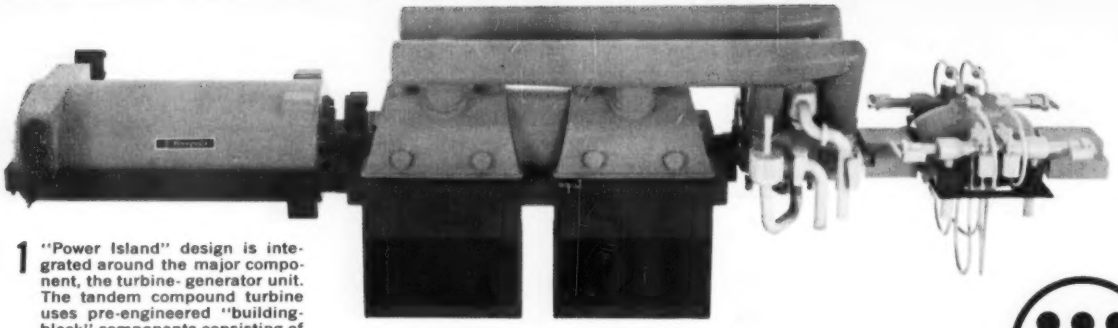
You can be sure . . . if it's

Westinghouse





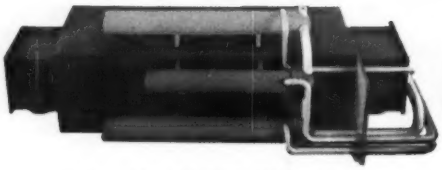
Model shown is of actual "Power Island" unit for 350 megawatt steam plant purchased by Texas Electric Service Company at its Handley plant in Fort Worth. Design and location of all equipment permit use of simplified foundation and piping, conduit and wiring layouts. Entire Power Island is integrated to facilitate full automatic operation using Westinghouse PRODAC-IV digital control computer.



1 "Power Island" design is integrated around the major component, the turbine-generator unit. The tandem compound turbine uses pre-engineered "building-block" components consisting of a high pressure element, intermediate pressure element and low pressure elements.

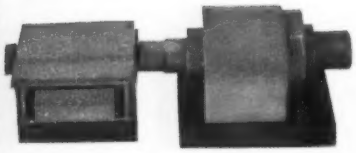
Westinghouse

2 Generator is hydrogen-cooled and THERMALASTIC insulated. Side mounted bushings permit close coupling of generator and power transformer to eliminate bus work and reduce over-all plant area.

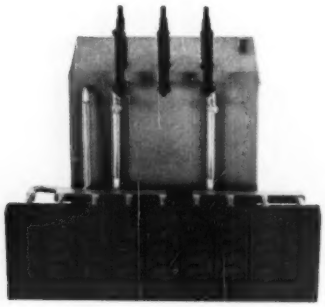


3 Use of two side inlet, single pass, radial flow, deaerating condensers allows low pedestal height with major reduction in foundation and piping. Completely welded, high pressure feedwater heaters with clad tube sheets are located to achieve further savings in space and piping.

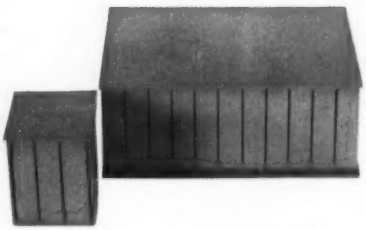
4 Flash evaporator with integral low-pressure feedwater heaters form a single structure below the turbine. Unit provides all make-up for system.



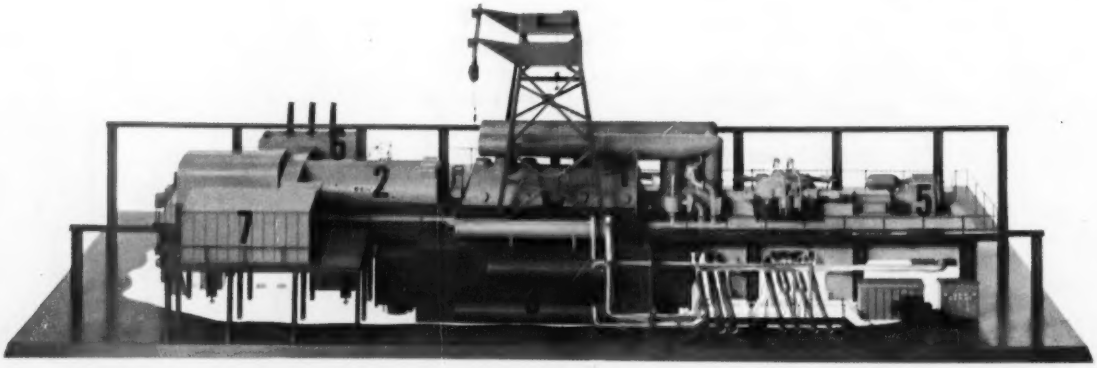
5 Main shaft-driven boiler feed pump simplifies plant layout, reduces condensate piping and enables unit to operate through low frequency and/or low voltage surge conditions.



6 Main transformer is close coupled to generator to minimize plant size and eliminate isolated phase bus. Auxiliary power transformer is included in same tank in isolated compartment.



7 Switchgear, located close to transformer, controls station auxiliaries. Shelterfor-M* enclosure provides weather protection. Outdoor power and motor control centers are strategically located to operate plant auxiliaries.



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Electrical World

AUGUST 21, 1961
Vol. 156, No. 8

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NEXT WEEK

DON'T MISS the Electric Utility Methods special report.

The Electrical Week

FUTURE NEWS ▶ **Look for the Justice Department to finish working out consent decrees** with defendants in the Philadelphia cases soon. General Electric will be lone holdout on signing because of a clause barring "unreasonably low" prices. Signing of the consent decrees will end the civil antitrust suits filed with the criminal suits.

LATE NEWS ▶ **Allis-Chalmers files protest** with Corps of Engineers charging that apparent low bid submitted by Baldwin-Lima-Hamilton for thirteen 212,400-hp turbines for John Day and Lower Monumental Dams in Washington was "inaccurate and misleading" about the amount of foreign manufacture involved. A new Buy-American controversy seems in the offing, as A-C is appealing also on the basis of the effect of foreign manufacture on the domestic unemployment situation. It is also raising the question of national security and defense and asks that the matter be referred to the Office of Civil and Defense Mobilization. Corps is studying the protest.

Talk on Capitol Hill indicates supporters of generating facilities at Hanford may attempt to work out some kind of a compromise plan. Nature of a proposed compromise is not disclosed, but one idea is to limit the installation to one generator of 350-400 Mw, which is about the amount of electricity used at Hanford. Sens Pastore, Anderson, Jackson, Hickenlooper, and Dworshak are named to the conference committee. Conference schedule has not been set. Among various retaliatory measures proposed against investor-owned utilities opposing Hanford generation is one by Sen Lee Metcalf (D-Mont.). He suggests the government may not renew 50-year FPC licenses on investor-owned hydro projects.

Senate confirms President Kennedy's elevation of Judge J. Cullen Ganey to the Third Circuit Court of Appeals in Philadelphia.

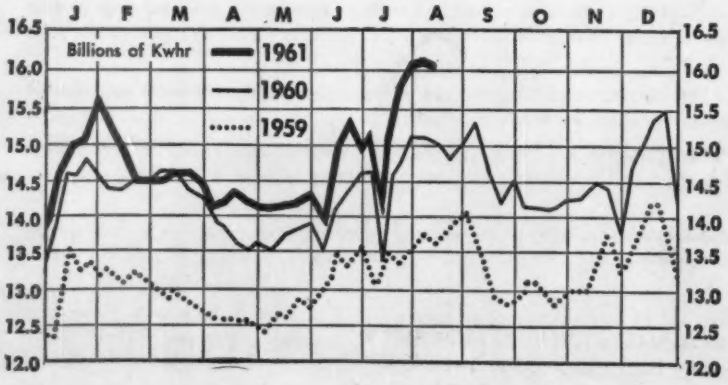
Westinghouse increases prices 5% Aug. 17 on step-type voltage regulators.

General Electric reduces price of 196-kv TBI bushings from $3,750 to $3,150. The company also increases prices 5% on all utility voltage regulators, including the induction type, effective Aug. 12.

Bomb explosions shatter power transformers in two sections of Havana, Cuba, interrupting electric service over a large area of the city. The *Miami* (Fla.) *News* speculates that the bombs were planted by anti-Castro Cubans starting another sabotage campaign.

WEEKLY POWER OUTPUT—Up 6.9%

(Week Ending Aug. 12), Kwhr 16,080,000,000



Per Cent Change From Previous Year

	July 29	Aug. 5	Aug. 12
Total U.S. (R)*	+ 6.8	+ 6.7	+ 6.9
New Eng.	+ 9.8	+ 5.4	+ 9.7
Mid. Atlan.	+14.0	+ 6.2	+ 9.6
Cent. Ind.	+ 2.4	+ 6.6	+ 5.1
West Cent.	+ 4.9	+13.0	+10.2
Southeast (R)*	+ 6.5	+ 6.7	+ 5.1
South Cent.	− 1.1	+ 2.9	+ 6.9
Rocky Mount.	+ 7.5	+ 5.2	+ 7.4
Pacific			
NW	+ 7.6	+ 5.9	+ 3.9
SW	+ 6.7	+ 9.6	+10.1

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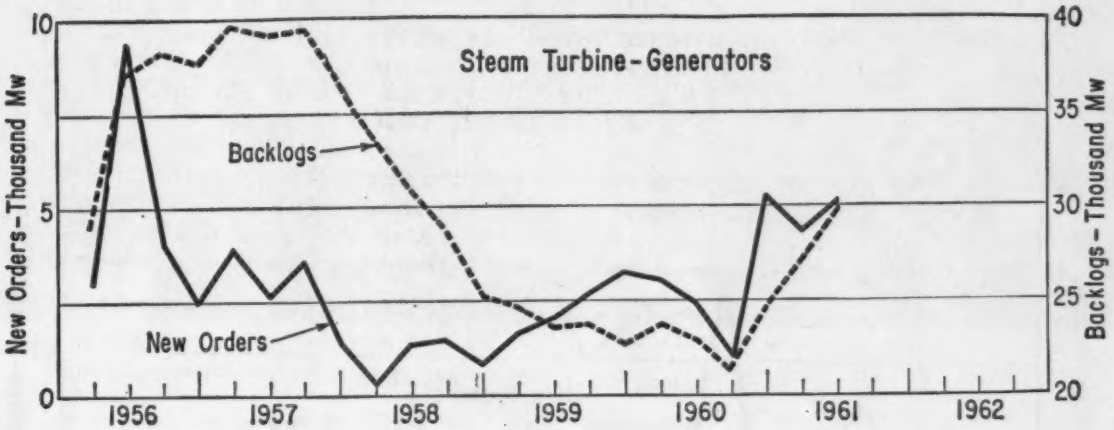
Source: Edison Electric Institute

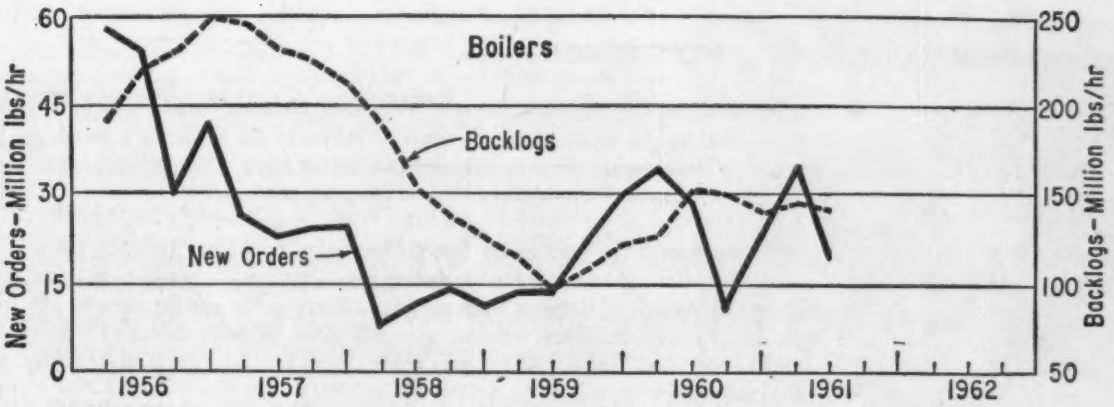
* Revised

HEAVY ELECTRICAL EQUIPMENT NEW ORDERS SHOW MIXED CHANGE

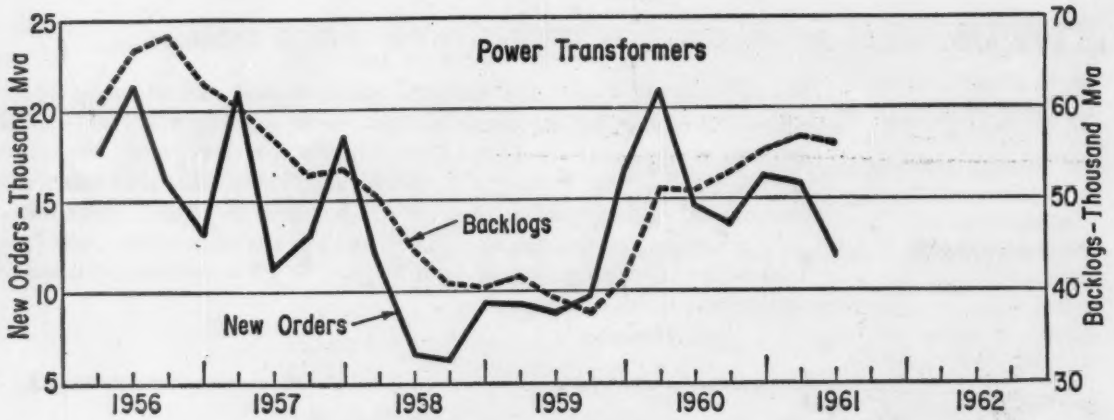
The heavy electrical equipment new-order picture showed a mixed change during the second quarter, but the picture continues to be generally bright in terms of backlogs of manufacturers. Edison Electric Institute's mid-year report shows that thermal and hydraulic generating equipment improved in both new orders and backlogs during the second quarter. For transformers and boilers, there was a drop in new orders, but the resulting dip in backlogs was much milder. (All lines used in the following graphs represent the sum of US manufacturers' domestic and export business.)



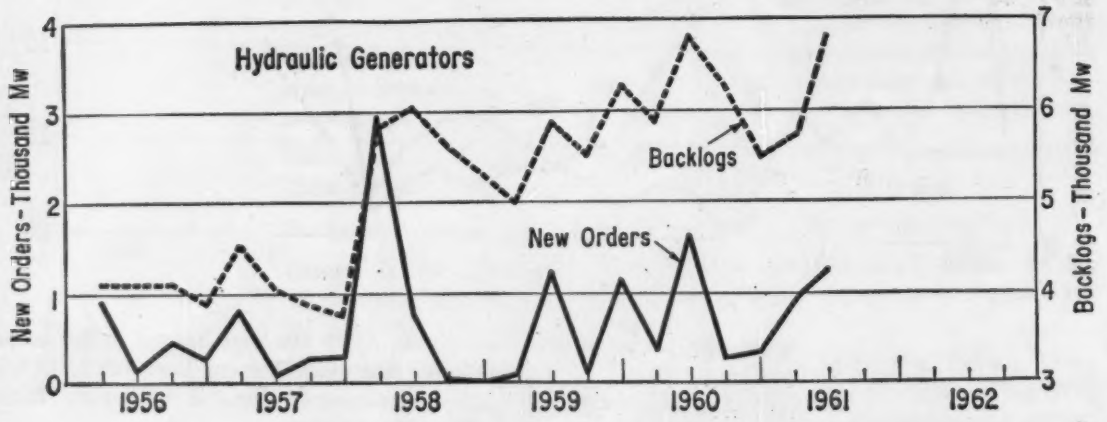
Specifically, for steam turbine-generators, 5,049 Mw were ordered in the second quarter, of which 4,512 Mw were for US customers. This compares with 2,534 Mw ordered by US customers in the first quarter out of a total of 4,414 Mw. Backlogs were at 29,892 Mw as of July 1, 1961.



For boilers, some 19,894,000 lb/hr were ordered, of which about 75% is for US customers. Backlogs stood at 141,043,000 lb/hr. EEI reports that boilers have yet to be ordered for some 8,000 Mw of large steam t-g sets already ordered.



For power transformers, 11,986 Mva were ordered, of which 785 Mva were for export. Backlogs slipped a bit to 56,143 Mva.



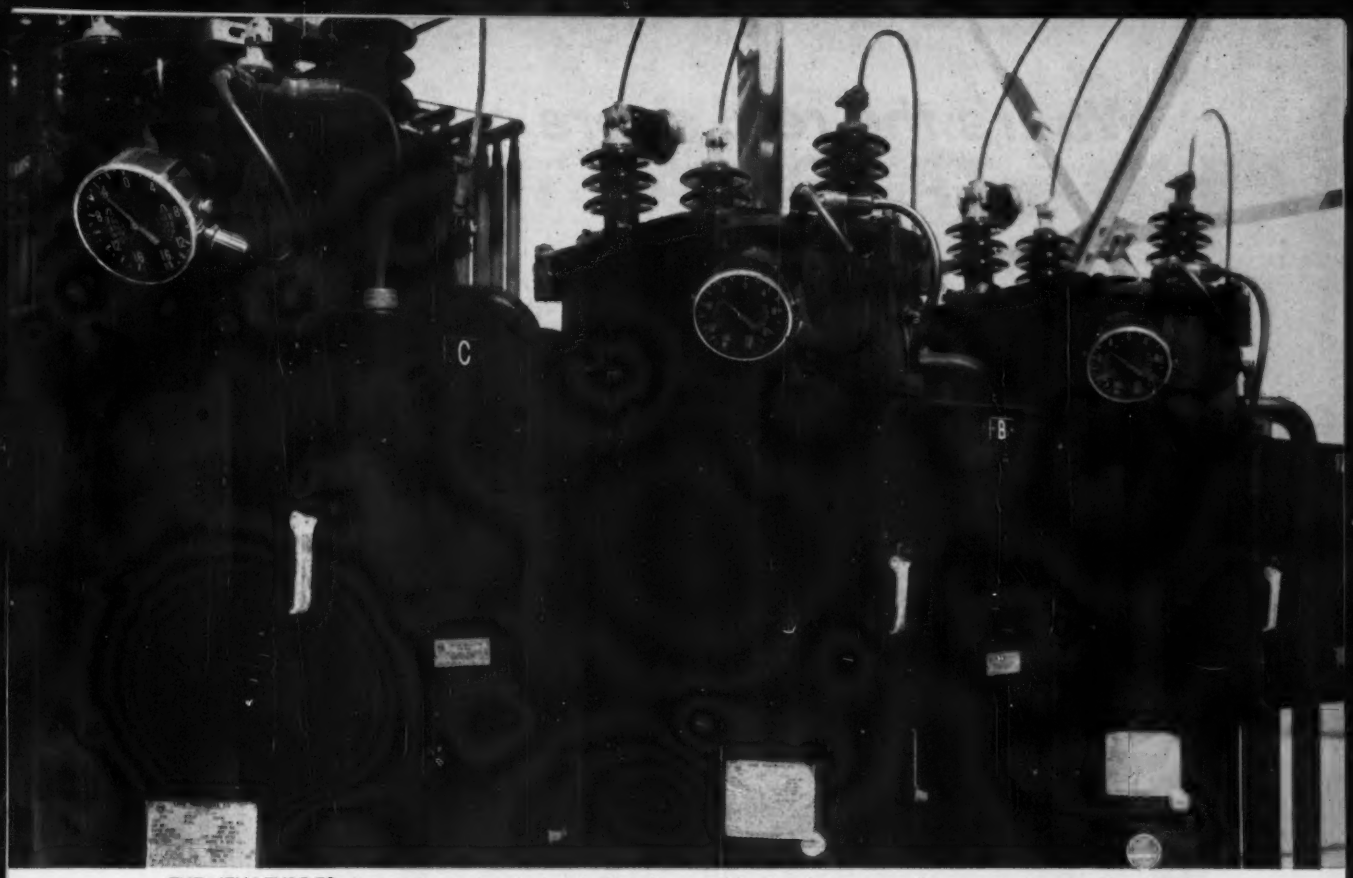
Hydraulic generators again showed a bright picture with backlogs at a record level of 6,842 Mw. New orders totaled 1,237 Mw, with none for export.

ALUMINUM CONDUCTOR PRICES REVISED

Revised prices for bare and covered aluminum electrical conductors have been announced by the Rome Cable Division of Alcoa as the result of a recent study made by the company on materials and production costs. The revisions, effective Aug. 9, involve both upward and downward price changes.

Price increases have been made for: all-aluminum conductor (ranging from 1% for the smaller sizes to 4% for the larger sizes); covered or weather-resistant all-aluminum conductor (ranging from no price change in the smaller sizes to 1% for the larger sizes); aluminum building wire and serice entrance cables (5% increase on all sizes); and bare ACSR (ranging from 1% to 8% for sizes 336,400 CM and above).

Price decreases have been made for Waxwing, Partridge, Ostrich, and Merlin conductors and for a group of high-strength conductors used principally as overhead ground wires. As an example, the company said Partridge conductor was decreased in price to $0.3587/lb, as against the previous price of $0.3673/lb.



THE NEW TYPE ES electronic sensing device designed by L-M for its type RSD regulators is readily accessible in the externally mounted control cabinet. Here is a substation installation by a midwest utility.

New L-M Electronic Regulator Control Cuts Maintenance, Ups Speed, Accuracy

L-M announces revolutionary new type ES Electronic Sensing Control for L-M Voltage Regulators. Eliminates contacts and their maintenance; eliminates moving voltmeter parts; provides faster, sharper response, constant band width.

Recently L-M engineers have replaced the accurate contact-making voltmeter in L-M regulators with an even more precise and dependable electronic sensing control. This control has been thoroughly tested. Completely static parts provide utmost reliability, and extremely sharp and fast response to voltage variations.

Now there are no moving parts to wear out or malfunction. No contacts in the sensing mechanism to erode and require replacement. Band width easily set by adjusting knob on face of meter. Band width may be adjusted from ± less than one volt to ± 6 volts. Two neon lamps indicate when voltage is outside band width. Upper lamp lights for high voltage, lower for low voltage. Once set, band width will not drift from desired setting.

Get Details From The L-M Field Engineer

L-M offers a really outstanding regulator. And L-M's new electronic control is outstanding, too. Investigate, test, and standardize on L-M Voltage Regulators. To convince yourself, ask the L-M Field Engineer for bulletins and application data. Or write Line Material Industries, Milwaukee 1, Wisconsin.

A. Electronic Sensing Device
B. Neon Lamps
C. Band width adjusting knob

L-M'S EXCLUSIVE NEW electronic sensing device for L-M Voltage Regulators. Transistors assure fast and extremely accurate response to voltage changes. Maintenance is reduced because there are no contacts to erode and replace.

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
Regulators

McGRAW EDISON

520

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

What's the real score on 4x4's?

FORD 4x4 PICKUPS GIVE YOU MORE!!!

Ford 4-wheel drive sales have increased 54% in the last three years! And with good reason. Here's how the six-cylinder Ford ½-tonner compares to another reasonably priced 4 x 4 pickup. Ford gives you: **28% MORE HORSEPOWER** with modern valve-in-head, short-stroke Six. Here's reserve lugging power to make jobs easier, plus gas-saving economy. **84% STRONGER FRAME RAILS** to take rugged off-road work in stride. The Ford frame has a 4.74 section modulus for extra rigidity and strength. **23% MORE CLUTCH FRICTIONAL AREA** on Ford's heavy-duty 11-inch clutch. And semi-centrifugal design provides greater torque-transmitting capacity as the engine speed increases. **99% MORE LOADSPACE** in Ford's sturdy 8-foot Styleside Pickup box. A full 70.6 cubic feet of cargo area for bulkiest loads. **50% MORE FRONT AXLE CAPACITY** for greater durability. Ford's axle is rated for an extra 1,000 pounds!

NOW, YOU CAN KEEP YOUR FLEET ALL FORD with Ford all-wheel drive trucks, too!

FORD TRUCKS COST LESS

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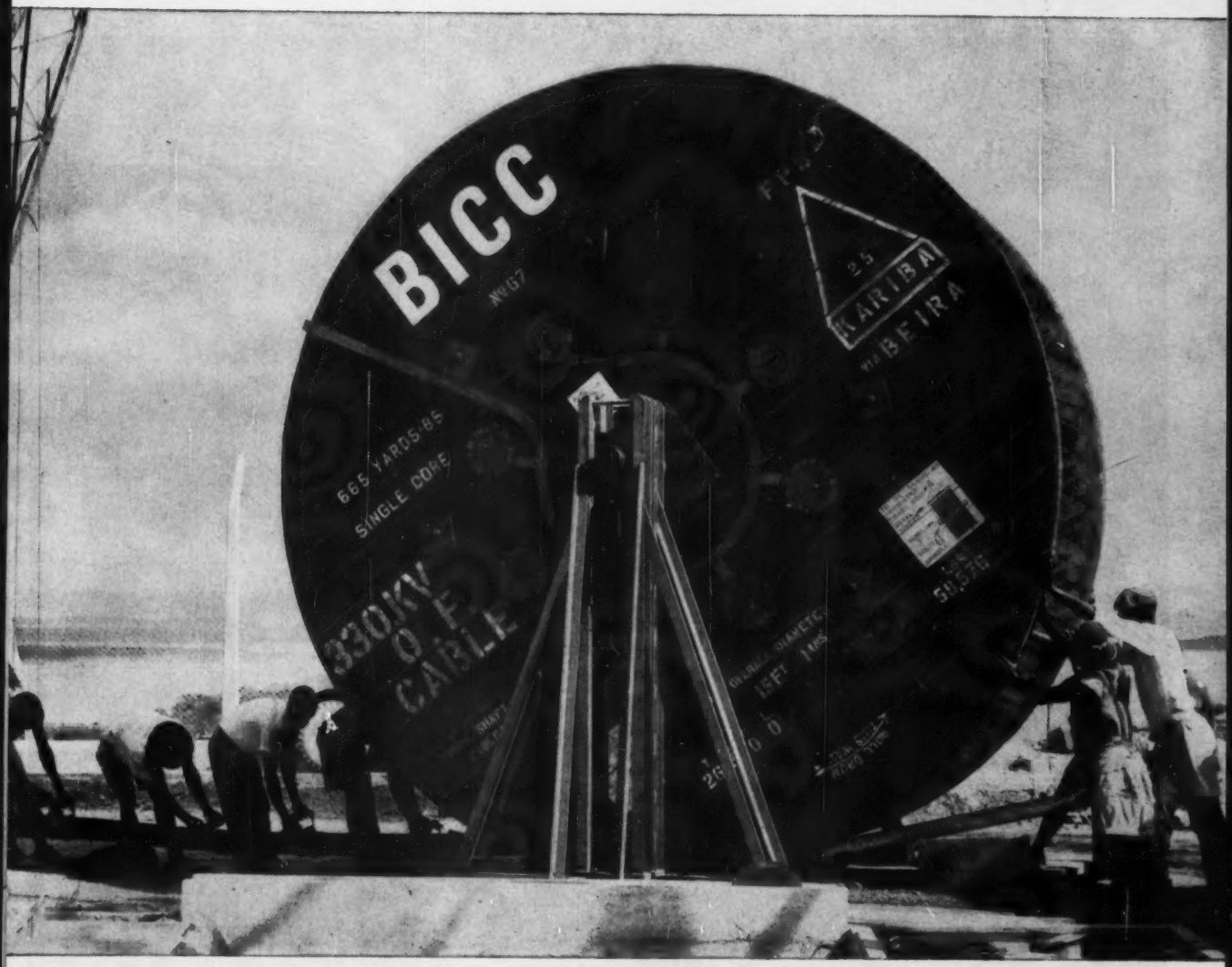
FORD DIVISION, Ford Motor Company

330,000 VOLT CABLES AT KARIBA



BICC

Ascending a 540 foot vertical shaft in the rock, twelve single-core 330,000 volt oil-filled cables link the Kariba power station with the transmission lines above.

To overcome installation difficulties each cable was produced in a continuous unjointed length, the longest being 2,000 feet. Total length of 330,000 volt cable supplied—20,100 feet.

These cables, operating at the highest voltage in Africa, were designed, manufactured and installed by the BICC Group.

The Electrical and Mechanical Consulting Engineers: Messrs. Merz & McLellan.

BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London, W.C.1, England

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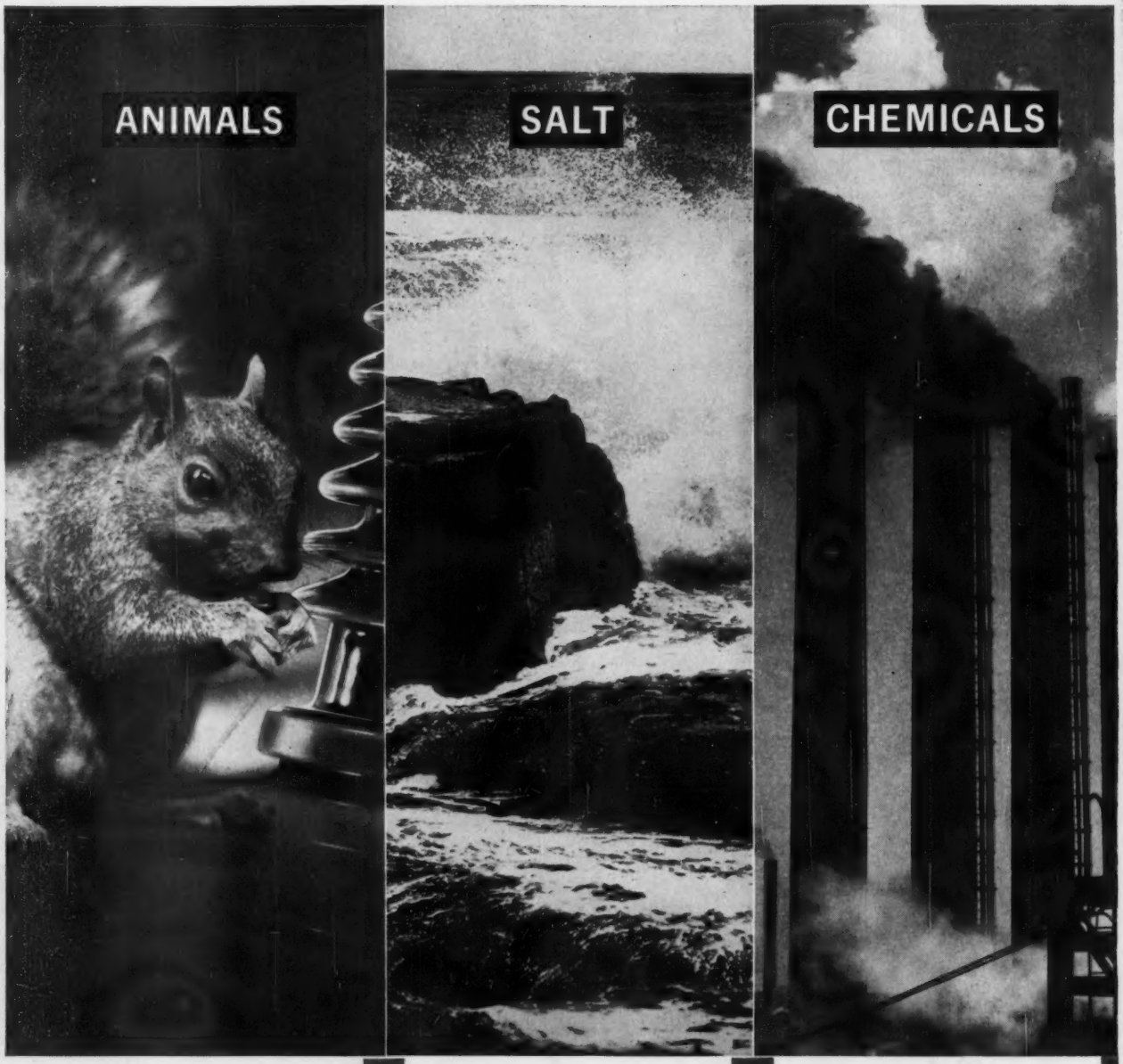
ARMORTEC STANDS UP TO

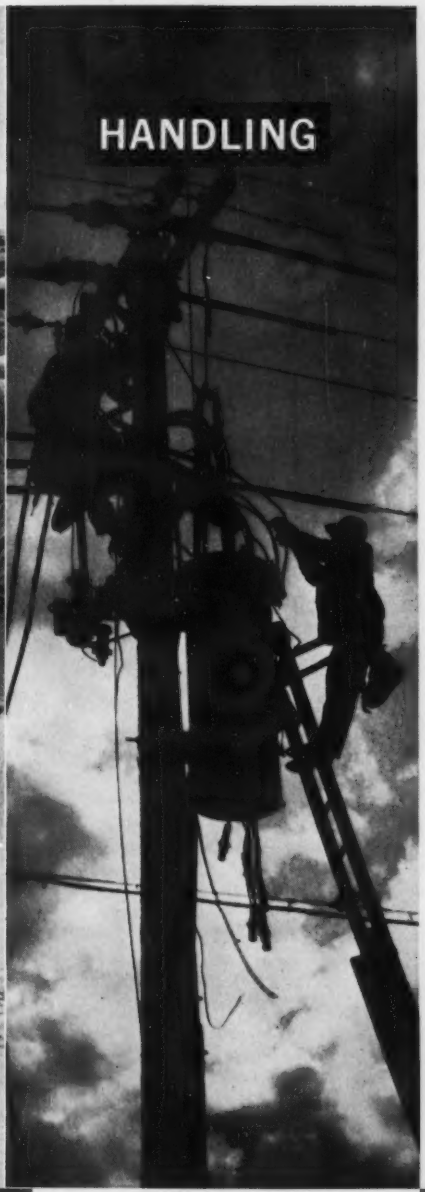


ARMORTEC eliminates outages due to birds and animals. Applied up to six times thicker than conventional paint coatings. Provides 1,100 volts per mil insulation on the transformer tank, cover and cover band.

ARMORTEC coating is uniform. Sharp edges and corners fully protected. Armortec leaves no room for rust and corrosion from salt spray . . . 10,000 hours of salt spray test had no effect.

ARMORTEC is pure vinyl. Caustics from industrial smokestacks can't hurt it. Armortec is corrosion-proof . . . over 6,000 hours of weatherometer exposure proved it.

COSTLY TRANSFORMER ENEMIES!



Check how much Armortec will save you!

Trouble Source	Your Costs for Transformer Repair and Replacement
Birds and animals	$.....
Corroding salt spray	$.....
Industrial fumes	$.....
Sun and windblown sand	$.....
Transportation and installation handling	$.....
TOTAL	$.....

Armortec stands up to these costly transformer enemies . . . Protects transformers like no other coating.

Armortec is not paint. It is pure vinyl plastic. It is fusion-bonded to the entire exterior transformer surface: the tank, cover and band. It is tough, resilient, indestructible. Armortec protects your transformer investment from everything under the sun!

Save transformer repair and replacement dollars with Armortec. Standard on all R T & E pole-type transformers . . .

AT NO ADDITIONAL PRICE

ARMORTEC is unaffected by sunlight. Won't blister, peel, chalk, or craze. Armortec is abrasion resistant. It has the resiliency of rubber, shrugs off driving sand . . . verified by actual sand blast demonstrations.

ARMORTEC is tough. It can take rough handling. Armortec can't be chipped off because it's fused to the metal. Grueling impact testing proved Armortec 100 times superior to conventional paint.

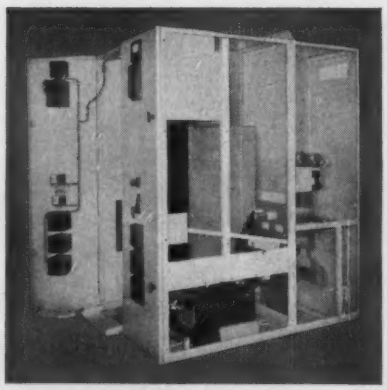
RT&E
CORPORATION
Waukesha, Wisconsin
Portland, Oregon
Arlington, Texas

More features make Westinghouse metal-clad switchgear

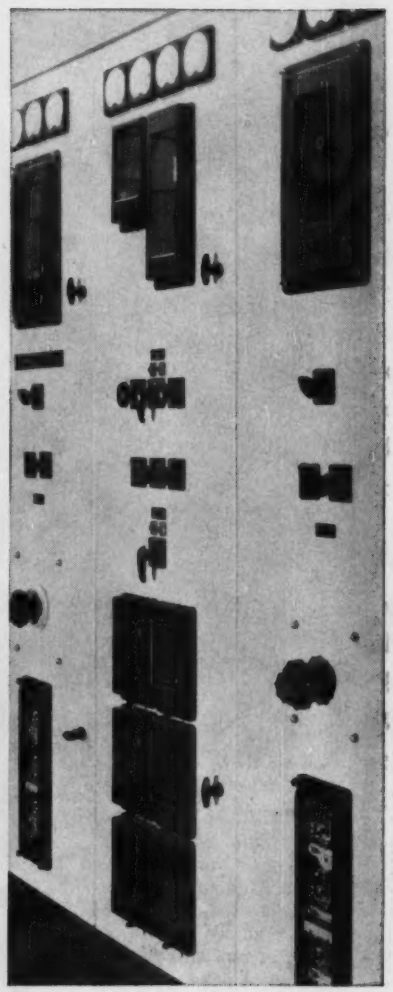
Westinghouse metal-clad switchgear is design proved in the Westinghouse High Power Laboratory. It meets all industrial, electric utility, commercial, institutional, and other needs for 75 to 1000 mva service inclusive, 4.16 through 13.8 kv.

Check below for advantages of this equipment that are of major importance to you.

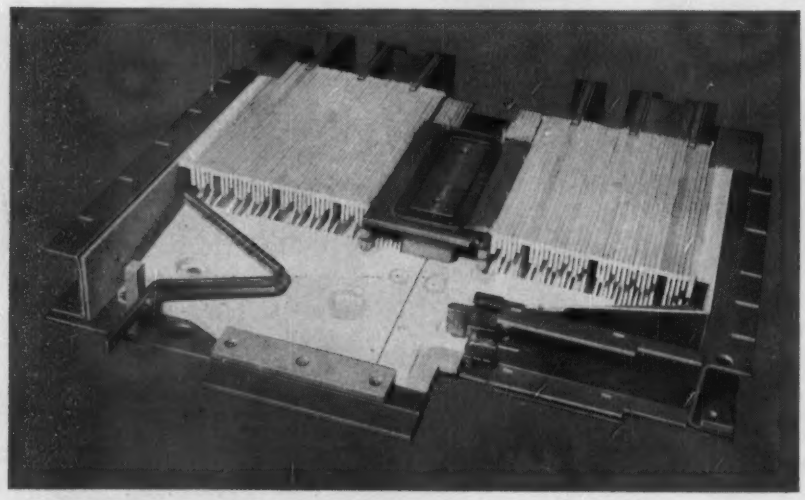
For further information, call your Westinghouse representative or write for a copy of Descriptive Bulletin 32-250 to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*



Balanced insulation protection is provided by the exclusive "Limitrak" insulation system on bus supports, arc chute enclosure and breaker bushings.

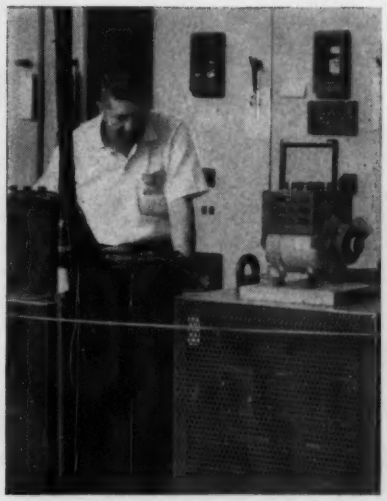


Adequate space for varied relaying and instrumentation is assured by full height front panels.



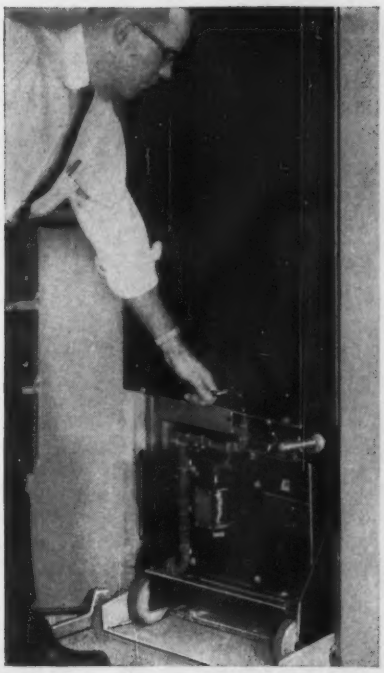
Fast, positive circuit protection is provided by the De-ion principle of arc interruption with center coil arc chute design.

your best buy

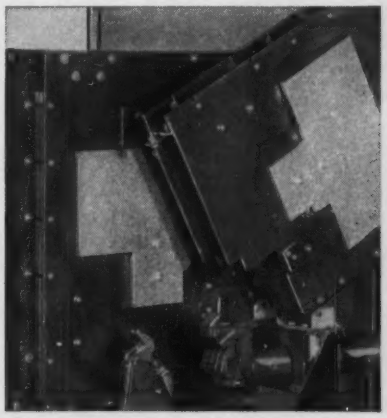


Proper component functioning is verified by a continuing program of production inspection and testing.

Front panel is protected during assembly, shipment and installation by strippable plastic coating.



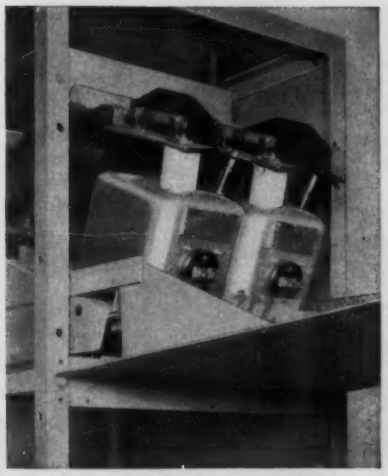
Simple, quick inspection, maintenance and replacement of DH breakers is made possible by horizontal drawout construction.



Hinged arc chute permits easy tilting for inspection and maintenance of contacts with DH breaker in drawout position.

Thorough phosphatizing and priming treatment safeguards against corrosion and provides a superior base for finish coat.

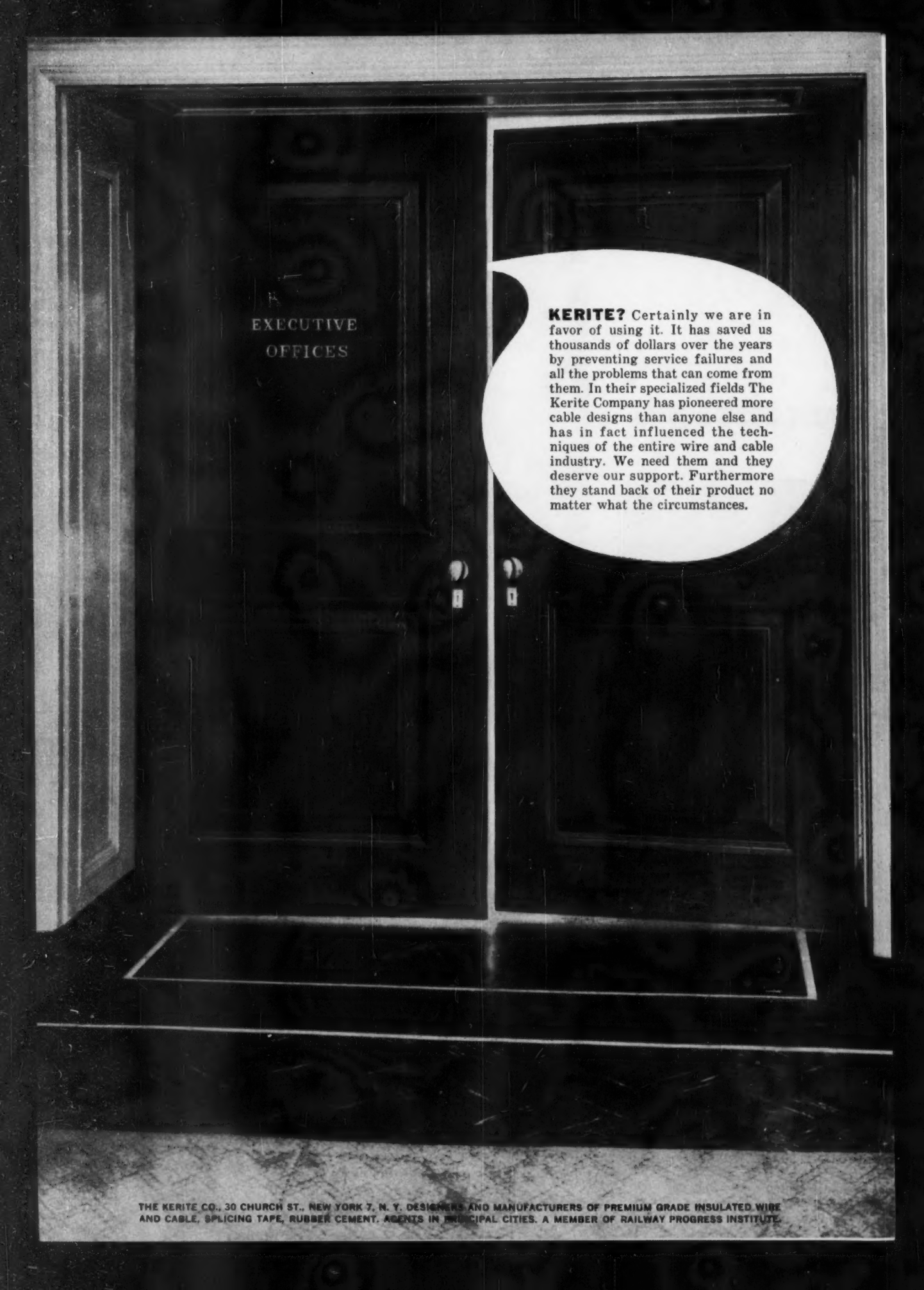
Complete joint sealing with polyester compound at main contact supports and main bus provides full insulation.



Personnel are protected by separate compartment drawout-type mounting of potential transformers.

Westinghouse

J-61014



KERITE? Certainly we are in favor of using it. It has saved us thousands of dollars over the years by preventing service failures and all the problems that can come from them. In their specialized fields The Kerite Company has pioneered more cable designs than anyone else and has in fact influenced the techniques of the entire wire and cable industry. We need them and they deserve our support. Furthermore they stand back of their product no matter what the circumstances.

THE KERITE CO., 30 CHURCH ST., NEW YORK 7, N. Y. DESIGNERS AND MANUFACTURERS OF PREMIUM GRADE INSULATED WIRE AND CABLE, SPLICING TAPE, RUBBER CEMENT. AGENTS IN PRINCIPAL CITIES. A MEMBER OF RAILWAY PROGRESS INSTITUTE.

Editorial Comment

AUGUST 21, 1961

Mr. Clapp Worries About His Apron Strings

Administrator Norman Clapp is bothered with "a good deal of mail at REA these days, and some of it is critical." Some is from power companies, "or in some cases, just plain citizens who read the power companies' propaganda."

Among other things, he says, this mail insists that REA's job and the co-ops' job "is completed because 97% of the farms in the US are receiving central service today." In our view, it's gratifying that "just plain citizens" are finally getting the message: the federal government's role in rural electrification should be rapidly diminishing as the original goal—central station service to the nation's farms—approaches completion.

Whether the co-ops' role is over is a different point. But Mr. Clapp wants to keep the government in the business and the co-ops tied to the government's apron-strings whether they need it or not. So he's changed the rules, and without benefit of Act of Congress. Now (EW, May 22, p 61) he wants to "preserve the integrity" of the co-ops, by offering them 2% generation and transmission loans if this integrity, in his opinion, is threatened. Under his new rules, this criterion alone would be sufficient.

Apparently the critical mail has struck a sore point here. The complaints, he says, strike at REA loan secrecy which can prevent power companies from knowing of a G&T loan application until it's granted. Why, he cries, the power companies actually want to know "what sort of a price they have to meet to prevent the granting of such a loan . . ."

We thought, somehow, that was the American competitive way. If, indeed, a company, through existing facilities and bulk efficiency can meet a co-op's G&T costs based on 2% loans, it seems equitable it should be permitted to bid to do so. How is the co-op—or the consumer—thus damaged? Doesn't the government gain if it is thus relieved of making a 2% loan with its 3¼% money?

With each passing year, most co-ops have shown increasingly they need little government protection. More often than not they are well-operated and good business citizens in most senses of the phrase.

We've long urged those ready for it to start the final steps toward eventual operation under the same ground rules as their brother power companies, subject to regulation, open-market financing and taxation.

Mr. Clapp plainly doesn't want this. He wants only to have the apron strings tied tighter and tighter.

Washington Finds Shelter in Unexpected Places

Many duties have been proposed for Civil Defense. But one of them has us a little perplexed. Are we now planning fallout shelters for every living creature from the biggest man to the smallest mouse?

An often-quoted Washington spokesman, according to a recent news item, is proposing the prompt conversion of city subway tunnels to endless air-raid shelters. This, we believe, is in keeping with British practice during World War II and could conceivably be applied again—with appropriate improvements to meet needs of the Atomic Age. But where suitable subways are not at hand, he continued, the local utilities' manhole and duct lines should be adapted to the same end. The second proposal leaves us a bit perplexed. Does he consider US citizens so small that they could hide by the thousands in a four-inch pipe? Or is his plan so all-inclusive that it would shelter even the smallest mouse?

Udall Speaks on Hanford and Delaware

- **Hanford generation might be placed under public works**
- **Interior Department approves Delaware River Compact**

The Kennedy Administration's fight to win approval for the Hanford power facilities is far from dead. Interior Secretary Stewart Udall told a press conference that "new tactics" were being brewed on Capitol Hill to restore authorizing legislation for electrical generators for the 800-Mw plant which the House of Representatives voted down a week earlier.

One of these tactics, it is reported, could come from House Appropriations Committee Chairman Clarence Cannon—a legal maneuver whereby Hanford could actually be authorized in the 1962 Public Works Appropriation bill. Cannon has held up committee action on the long-delayed bill until he knows whether Hanford power facilities will be included in the AEC authorization bill.

Senate and House conferees, also, could still vote to authorize Hanford power, and another House vote would be required.

Udall told his press conference that the "real issue" at Hanford was one of "waste." He said he's never seen such an effort made before by the private utilities to block legislation, and he added that the utility objections were based on "misconceptions." Udall likened the blocking of Hanford power generators to leaving out generators at a federal dam on the Columbia.

Delaware Compact Approved

The Delaware River Compact also was given the green light by Udall at the press conference. The compact, as proposed in legislation now before the Senate Public Works Committee, calls for a compact commission composed of one representative each from Pennsylvania, New York, New Jersey, Delaware and the federal government.

Udall said he would support the compact legislation, which already has been approved by the House of Representatives, if the following six amendments were included:

(1) Employment by all contractors on commission projects should be subject to provisions of the Bacon and Walsh-Healey Acts, relating to wages and other labor standards.

(2) The compact would in no way limit the authority of the Health-Education-Welfare Department regarding pollution.

(3) The commission would not have power to act in conflict with the federal government, except that approval of a comprehensive plan for the Delaware by the federal member could not be altered by the federal government, once granted.

(4) The President could delete any provision of the compact's master plan as it might apply to the federal government.

(5) The federal member would review comprehensive plans every six years, and could withdraw federal support at such intervals.

(6) All sales of hydro-power generated at commission projects would be sold subject to public preference laws.

Udall said the first five points had been agreed to by state representatives, but issue of public power preference was unresolved.

Giant Federal Power Whispered

Interior Secretary Stewart Udall has unveiled the Kennedy Administration's long-range plans for federal power expansion to a select audience in Washington.

The meeting was called on the timely issue of the Hanford reactor battle in Congress, and how Hanford's power facilities would fit into a nationwide federal nuclear power program—about a dozen huge federal reactors located on a federal transmission grid at strategic points throughout the country. Hanford would be first of these.

Included in Udall's planning, it is reported, would be major transmission interties between all regions of the US and the power plants. The lines would stretch eastward into Vermont and possibly even toward Southern Florida, according to some reports.

Those attending the meeting included Assistant Interior Secretary Kenneth Holum, General Manager Alex Radin of the American Public Power Assn, General Manager Clyde Ellis of the National Rural Electric Cooperative Assn, representatives of the AFL-CIO and the United Mine Workers.

One kicker developed at the meeting—the UMW representatives objected strongly to the plans, claiming that: **(1)** the nuclear power reactors, obviously, would work to the detriment of the coal industry, **(2)** the broad sweep of Udall's plan also would be a serious blow to private enterprise, probably sounding the death knell for the nation's power industry.

Although there was no confirmation of the presence of a "master map" for federal power development at the meeting, there is every indication that the Administration did have a general, fairly detailed plan of development. Some of this plan is based on an unreleased 1952 Interior Department document, prepared by the Bureau of Reclamation and titled, "A Study of Future Power Transmission for the West." This nine-year-old document envisioned a power grid from the Columbia Basin eastward to the Great Lakes, now extending even further toward New England. The Colorado Basin would be intertied with California, the Northwest, the Missouri Basin, and eastward into Missouri. Missouri would be tied northward with the Columbia-Great Lakes line, and southward to the Gulf area. And, reportedly, the Gulf states now are proposed for an eastward extension into Florida.

None of the parties at the meeting will discuss what took place, other than that it did occur, and what its general theme involved. Details of the meeting have been given to key Congressional and Administration leaders in strict confidence.

Chances Growing Slim For Tax Legislation

The chances for tax legislation out of Congress this year were flickering out last week as the Ways and Means Committee began coming to a final vote on the legislation it has considered for months.

Thus it appeared that the Administration's hopes for a bill including an 8% tax credit based on purchases of machinery and equipment and revenue raising measures to provide an offsetting $1.1 billion in revenue would not be met.

Electric utilities have a competitive interest in the bill. As tentatively approved by the House Ways and Means Committee it would have provided the 8% tax benefit to gas pipelines and to industries installing their own generating capacity but would specifically deny it to electric utilities.

There was still some likelihood at mid-week that the House committee might report out some revenue-raisers—perhaps a scheme for withholding federal income taxes on payments of interest and dividends.

But there is little likelihood now that the Senate Finance Committee will hold hearings on the bill. Chairman Harry F. Byrd (D-Va.) is not at all anxious to take up the measure, and the whole thing may be put on the shelf in the House.

This means no action this year on such things as tightening of tax treatment of overseas earnings, expense accounts, co-ops, savings and loan associations, and income from sales of depreciable property.

O'Connor Takes On FPC Duties

Lawrence J. O'Connor, 46 (at right in picture), President Kennedy's third Democratic appointee to the FPC, was greeted by Joseph Swidler as he took office Aug. 14 after being sworn in by Supreme Court Justice Tom Clark. He replaces Arthur Kline, Republican appointed by former President Eisenhower, who is returning to private law practice in Cheyenne.

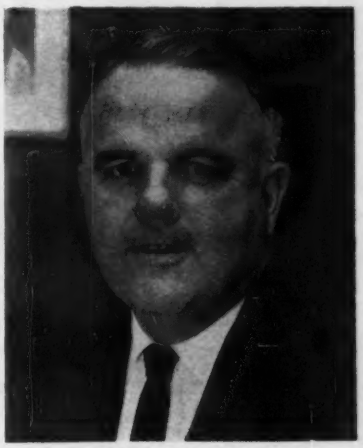
O'Connor was confirmed earlier this month by the Senate, 63-12, after a 33-hour filibuster against him by Sen William Proxmire (D-Wis.). Proxmire charged that Southwesterner O'Connor would serve oil and gas producers rather than consumers in his new post. The Senate Commerce Committee had recommended his confirmation unanimously.

A native of Tulsa, O'Connor graduated from Rice and Harvard, and is a licensed CPA. O'Connor has been vice president of the Houston district of the Independent Petroleum Assn of America, vice president of the Tax Executives Institute, vice president of Goldston Oil Corp, Houston. He was also an independent oil and gas consultant.

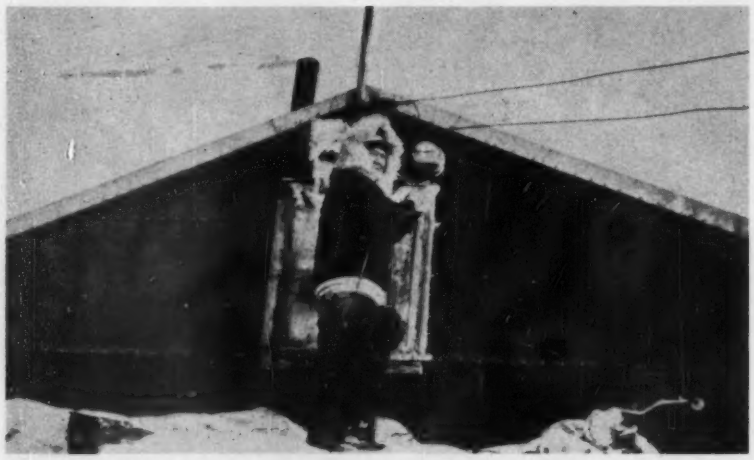
Investor-Owned Utilities Get Ally

A one-man war is being waged by Cincinnati insurance executive John J. Schiff (at right) against the Rural Electrification Administration's record $60-million loan to Hoosier Cooperative Energy. Schiff has written two letters to President Kennedy outlining his opposition to the loan; and he has received one reply, that from REA Acting Administrator R. H. Wood.

The Edison Electric Institute has sent copies of Schiff's letters to the presidents of all major US investor-owned utilities deploring the loan, which was granted to finance the construction of steam generating facilities for sixteen southern Indiana cooperatives that previously received power from investor-owned companies. For over one month Schiff was averaging better than a call a day from utility chief executives congratulating him for his stand. Although he has not succeeded in having the loan rescinded, Schiff maintains that he will continue to oppose the REA move.

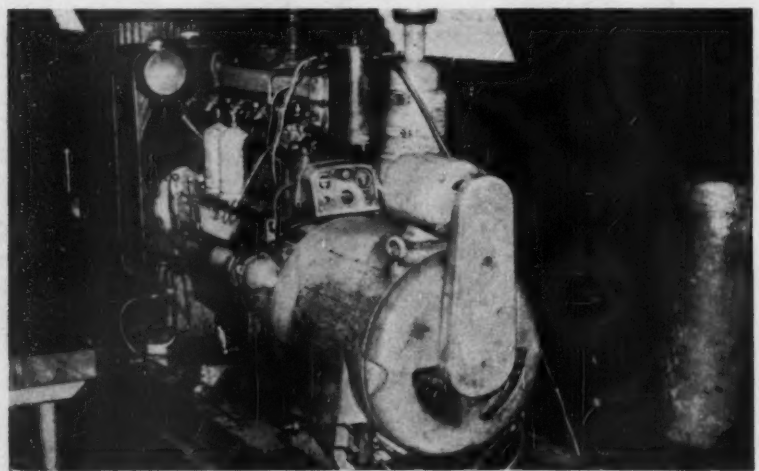


Snow-Bound Utility Finds Meters a Must



METER READER checks one of the second-hand meters that helped Point Hope settle dispute between appliance owners and their less-affluent neighbors

FUEL DELIVERIES are made to the Point Hope generating plant by dog-sled. A 53-gal barrel of diesel fuel costs the 62-customer co-op $24



GENERATOR is one of two 15-kw diesel units which provide power to community. Power is generated and distributed at 120 v, eliminating transformers

At Point Hope — a fish-hook-shaped piece of land jutting out from the northwestern coast of Alaska into the Arctic Ocean—an electric cooperative has passed another milestone. The Point Hope cooperative, the nation's northernmost supplier of electric power, has adopted metered billing.

Under the old system, each of the 62 customers of the co-op, about 125 miles north of the Arctic Circle, paid a flat rate of $8 a month. Each was allowed two light bulbs in his home, and he could keep them burning whenever the power plant was operating (8 am Monday to Friday night, Saturday night, and Sunday morning). But some of the customers ordered electric appliances by mail, and the others naturally began to protest the flat rate. To settle the dispute, the co-op bought some second-hand, two-wire meters and put in a new rate schedule: 12¢ a kwhr for the first 50 kwhr a month, 9¢ each for the next 50 kwhr, 7¢ for each kwhr over 100, and 5¢ a kwhr over 300 kwhr. Minimum monthly bill was dropped to $6. Now the customers can use all the electricity they can afford.

The Point Hope co-op got its start with a gift from the Army of two 15-kw diesel generators and a small supply of fuel. It purchased wire and insulators from the Kotzebue Electric Assn (only 30 miles above the Arctic Circle). Kotzebue provided technical assistance, and helped Point Hope place orders for other needed equipment.

Some of the poles are "lend-lease" from Russia. They floated across the Bering Strait from Siberia and washed ashore at Point Hope. The rest of the poles are anonymous pieces of driftwood.

The co-op has its problems. For one thing, fuel is expensive. A 53-gal barrel of diesel oil costs $24 at Point Hope. On cold winter mornings the units are difficult to start. But it has been spared other problems. It needs no transformers. The units put out 120 v, and power is transmitted at this level right into the homes. And, of course, it isn't at all worried about power companies extending their territories and taking away some of its customers.

Scheduled Additions to Electric Generating Capacity

Year	Thermal		Hydro		Total	
	No. of Units	Kw	No. of Units	Kw	No. of Units	Kw
1961*	86	9,089,900	46	3,495,600	132	12,585,500
1962	61	9,232,675	43	1,946,940	104	11,179,615
1963	45	7,335,025	49	3,229,422	94	10,564,447
1964	29	5,927,000	19	1,204,750	48	7,131,750
1965 and Later	15	5,106,250	21	1,426,805	36	6,533,055
TOTAL	236	36,690,850	178	11,303,517	414	47,994,367

*Includes 38 thermal units totaling 5,940,700 kw and 15 hydro units totaling 1,264,250 kw placed in commercial operation in the first half of 1961

EEI Looks for Rise in Output by Year-End

The Interim Electric Power Survey of Edison Electric Institute shows a possibility that electricity output for the last half of this year may bring the 1961 total to 5% or more higher than 1960. The prediction depends on weather conditions.

If the forecast holds true, kilowatthour output in the second half will have overcome a lag during the first half that was caused by depressed business conditions.

Of the total 12,585,500 kw of new generation to be added this year, 7,304,950 kw, or 58%, is now in commercial operation. EEI's breakdown of the 1961 total shows that 9,089,900 kw will be thermal generation and 3,495,600 will be hydro.

Generation scheduled to go on the line this year and through 1965 and later totals 47,994,367 kw. The ratio of thermal to hydro in 1961 is 2.6 to one, but the total scheduled through 1965 and beyond is 3.24 to one.

A new category in size of units has been added to the report. There are now two thermal units of 900 Mw or larger in EEI's tabulation. Largest percentage of new thermal capacity will be in units of 300 to 400 Mw. In this size range there are 27 units totaling 8,736,700 kw, making up 23.8% of the total thermal generation. This category represented 20% of the total in EEI's report in April.

Scheduled additions to generating capacity this year and later by ownership will be 32,343,950 kw by investor-owned companies; 8,842,252 kw by the federal government, and 6,808,165 by non-federal agencies. (See page 25 for details of new orders and backlogs.)

FPC Claims Jurisdiction Is Extended

The Federal Power Commission is claiming full jurisdiction over Consolidated Edison Co of New York as the result of the company acquiring a substation from Niagara Mohawk Power Corp.

In another action, involving Southern California Edison Co, the FPC is claiming jurisdiction over a contract to sell power to the city of Colton because SoCalEd uses federal power. FPC lawyers say this gives FPC jurisdiction over resales by SoCalEd.

The California PUC has been assuming and exercising jurisdiction over such sales, and stands to lose what it has considered its authority in similar cases.

Pleasant Valley Substation has been acquired by Consolidated Edison from Niagara Mohawk Power Corp and has been under operation of the former company since early this month. The substation is about six miles northeast of Poughkeepsie, in Dutchess County. This station has a tie also with Hartford Electric Light Co.

Extension of Con Edison's franchise to operate in New York State counties in addition to those in the company's long-standing operating area was permitted by stockholders at last May's annual meeting. The acquisition was made with the permission of the New York State Public Service Commission, and Con Edison has filed a concurrence agreement with the FPC.

Pleasant Valley Substation is the meeting point of the two systems, and 138-kv line now leaving it will be converted to double-circuit, 345-kv as part of Con Edison's EHV project. Lines to and from Pleasant Valley and their rights-of-way were included in the acquisition.

Power, Telephone U/G Trial Set

Illinois installations to have power and telephone cables placed in single trench with random spacing between them

Commonwealth Edison Co and Illinois Bell Telephone Co have been authorized by the Illinois Commerce Commission to make the first field trials in this country of power and telephone cables placed with random separation at the same level in a common trench for residential underground systems. The authorization stated that "elimination of the (existing) requirement for 12 in. of separation (between primary and secondary lines and telephone cables) can reduce the cost of digging and backfilling by about 25%."

Though this is a small part of the total cost of the underground plant, "it should stimulate the use of buried construction," according to the order. Underground installations covered by the order will be limited to primary service at 7.2/12.47 kv or less for 10,000 homes between now and June, 1963.

In granting this limited exemption to its General Order 160 the Commission found that the proposed underground installation of electric and telephone cables will not incur undue risk of injury to persons or of damage to property. Experiences of both utilities with joint buried construction, plus the results of experiments conducted last year by a joint subcommittee of Edison Electric Institute and Bell Laboratories at the Franksville, Wis., laboratories of Line Material Industries, were offered as evidence to substantiate the feasibility of random separation. The experiments at Franksville simulated one phase of a wye-connected multi-grounded distribution circuit and used test potentials of 7.2 kv and fault currents of 2,000 and 6,000 amp with 3-in. separation or none between buried power and telephone cables.

Five Recommendations Made

Based on the test results, engineering recommendations for the original field trials included:

1. Power and telephone cables may be installed at the same depth with random separation in a common trench even though there will be no separation at some points. However, separations obtainable without cost penalty are desirable.

2. Underground portion of the power system should be protected by a device capable of clearing line-to-ground faults in 12 cycles or less. Use of fuses that will allow initial opening and reclosing of the substation circuit breaker to clear transient faults should be avoided for underground branch circuit protection. Fuses should be sized according to load so as to clear these faults as rapidly as possible.

3. A bare neutral should be installed either as a separate conductor in close proximity to the primary cable or as a metallic sheath or concentric conductors over the cable.

4. At each transformer installation all existing grounds should be interconnected including primary and secondary neutral, power cable shield or sheath, and telephone cable sheath.

5. Common grounding of secondary neutral, telephone protector and shield of telephone service cable should be made at each service entrance in conformance with NEC requirements.

With their petition granted, the two utilities propose to approach home builders in the Chicago metropolitan area at once and secure their cooperation in the field trials. Under the order the companies can extend underground service to not more than 10,000 separate building units in not more than 100 separate jobs to the end of June, 1963. Power and telephone cables will be installed at random at the same level in a 30-in. deep trench; formerly a 36-in. deep trench was required to allow for the 12-in. separation.

For wye-connected, multi-grounded primary systems, Commonwealth Edison can use two types of cable for 7.2/12.47-kv distribution. The first is a No. 4, 19-strand tinned or alloy-coated copper conductor, strand shielded with a 19/64-in. wall of ozone-resistant butyl rubber, a 30-mil semi-conducting bedding or jacket over the insulation, and a covering of 12 No. 14 tinned or alloy-coated bare soft-drawn copper wire spiral wound over the cable. The second type is a No. 4, 19-strand copper conductor, strand shielded, with 14/64-in. wall of polyethylene insulation, a semi-conducting covering over the insulation and a 5/64-in. lead sheath. A concentric cable for 2.4-kv distribution will be similar to the 7.2-kv concentric cable but with a non-conducting, heavy-duty black neoprene jacket.

The telephone cable shall consist of a core of 19-gage to 26-gage copper wires, with individual wires insulated with extruded polyethylene. The core will be wrapped with Mylar or polypropylene, with the wrapped core sheathed in an 8-mil aluminum envelope and an outer 65-mil jacket of extruded polyethylene. The metallic sheath of the telephone cable will be bonded to the power system grounded neutral at intervals of not more than 1,000 ft.

Keynote Speaker Chosen for Conference

Louis H. Roddis, president of Pennsylvania Electric Co, will deliver the keynote address at the Fifth *Electrical World* Electric Comfort Heating & Heat Pump Conference in Washington, D.C., Sept. 25.

The two-day meeting will also feature a panel of speakers from the Federal Housing Administration, the Public Housing Administration and the Urban Renewal Administration, who will talk on the Administration's housing plans.

Mel Wright, a builder from Huntington, W. Va., and Clair Buchart, Buchart Associates, York, Pa., will tell why builders and architects like electric heat.

Copies of the complete program may be secured from: John D. Damon, *Electrical World*, 330 West 42nd Street, New York 36, N.Y.

DATA LOGGING EQUIPMENT at Carolina P&L's H. B. Robinson plant was the forerunner of the completely automatic Unit 3 at Goldsboro. The latter will be the world's first coal-fired unit under complete computer control

Build First Automatic Coal-Fired Unit

Carolina P&L expects computer controls for Goldsboro Unit No. 3 will provide safer and more efficient operation

R. S. TALTON, Superintendent of Power, Carolina Power & Light Co, Raleigh, N. C.

Unit 3, now being installed at Carolina Power & Light Co's Goldsboro plant, is being designed as the first automatic, coal-fired steam turbine-generator unit. Net capability will be 240,000 kw, and steam conditions 2,400 psi, 1,000F, 1,000F.

The unit will be a fully-outdoor installation with all major equipment above ground. It will burn bituminous coal having a heating value of about 13,000 Btu per lb, chiefly from the West Virginia fields. The coal-handling system for the two existing units will be increased in size and extended to take care of the new one. A 575-acre lake is being developed to supplement the cooling capacity of the Neuse River during low-flow periods.

Automation of Goldsboro's Unit 3 is another of CP&L's efforts to hold down the rising costs of plant construction and the costs of plant operation and maintenance, and to improve plant efficiency, reliability, and protection to the equipment.

Experience with the H. B. Robinson plant, which has the first monitor and results computer (MARC) in a CP&L plant, prompted the investigations that led to plans for automating Unit 3 at Goldsboro. The heart of the MARC system is a solid-state, general-purpose, digital computer with a 4,096-word core memory. This system checks and calculates the performance of major plant equipment, and of the over-all plant, and compares these values to optimum values stored in the computer memory. It scans up to 396 variables at a rate of five per sec. In case of an off-limit reading, the computer immediately re-reads the point in question. If it is found to be off normal again, the computer actuates an annunciator alarm and prints out an identification of the point, the time, and the value.

Presents Trends

The computer automatically by means of two typewriters logs 100 selected variables each hour or at any other time as demanded by the operator. It produces varying current signals suitable for presenting trend information of selected variables on miniature recorders. The computer can make decisions as to closure of output contacts to control external circuits in accordance with predetermined programs.

At present, such programs have only been planned. With about a year of operating experience, CP&L is convinced that this MARC system makes plant operation safer and more reliable, and results in an improvement in heat rate of 25 to 50 Btu per net kwhr.

The design of Goldsboro No. 3 unit was started by the time the Robinson unit was ready to go into operation with the MARC system. Again, as with each new design, CP&L took a critical look at what improvements could be made, plant automation being one possibility. The benefits expected from automation are: less operating manpower, improved heat rate, reduction of outage time, greater protection of equipment, and less maintenance.

Conservative estimates of the worth of these benefits did not quite justify the cost of automation. This meant that, if the decision was to be based only on the economics of the unit, it would be uneconomical to proceed. But it appeared that automation at present would lay the groundwork for substantial savings in plant costs, particularly when it has advanced to where conven-

tional controls can be omitted. With the prospective savings in mind, CP&L planned automation of Goldsboro's Unit 3.

It was apparent that there were some unsolved problems to be faced in automation of a coal-fired unit, but there was reasonable assurance that these problems could be solved by the time the system was scheduled to go into operation.

Called SPARC

After deciding to automate Goldsboro Unit 3, CP&L's consulting engineers prepared specifications and obtained bids from computer manufacturers. The specifications called for a solid-state, electronic, steam power automation and results computer system called SPARC.

On demand the system will reliably, safely, and efficiently start, operate, and stop the unit in a manner which will result in increased safety for personnel and equipment, increased plant reliability, and decreased operating costs. The system is being designed to start the unit from cold conditions but initially it will be programed for hot conditions. The system will accept the input signals made available, evaluate the reasonableness of the data, reduce it to a usable form, compare the reduced data with memorized data and other information, and arrive at logical predetermined operating decisions. It will then generate the proper signals to execute its decisions, while at the same time recording its action, inputs, and outputs.

Checks Continually

SPARC will evaluate the reasonableness of the data by checking the agreement of two out of three related indications, by checking continually the trends of inputs as a function of plant changes, by testing the approximate calibration of certain meters, and by inferring calibration of other meters. In this way the computer takes information, some of which may be imperfect, and from it makes proper decisions.

The computer will have a clock speed of at least 350 kc, a main core memory of at least 8,192 words, and an auxiliary memory of about 86,000 words. It will operate from approximately 2,150 inputs, 850 of which will be analog, 1,300 contact closures, and 20 pulses. It will control 375 pieces of plant equipment by means of 684 outputs, of which 34 will be analog and 650 digital. The ultimate addressing capacity will be 1,200 analog and 1,600 digital inputs. The outputs will be used to start all necessary plant equipment in the proper sequence in accordance with predetermined schedules.

After each signal has been generated to execute the schedule, the computer will follow up to see that the proper action has been taken. The starting of each piece of equipment will be permissive, contingent on its meeting requirements for safe and proper operation.

After the plant is in operation, the SPARC system will start, stop, adjust, and control plant auxiliary equipment in such a manner as to give the lowest Btu-per-kwhr rate for any given unit load. In trimming for optimum heat rate, the system will take into account the circulating water temperature, fuel analysis, atmospheric conditions, and severity of condenser fouling.

Initiates Shutdown

Tests have been run at the Robinson Plant, using the computer trend recorders, to record changes in plant performance when a plant condition is allowed to vary. Information from these tests is being used in the design of the Goldsboro SPARC system to enable it to establish optimum conditions more quickly after a change and thereby further improve the plant efficiency.

The SPARC system will shut down the plant equipment on demand, or because of unsafe conditions. When an emergency shutdown is required, the proper alarms will be sounded, and the computer will type out information on conditions prompting it. When those conditions are corrected, the SPARC system will restart the unit automatically.

The load at which the computer will operate the unit will be determined by the economic dispatch computer in the central dispatching office in Raleigh, N. C. This computer, operating for more than two years, determines the load to be carried by each plant to give the lowest total cost for power delivered, taking into account system losses.

In addition to its operating functions, the SPARC system will provide operating performance and historical data readily usable. It will compute the actual and optimum over-all plant efficiencies and print them. It will break down actual and optimum plant efficiencies into such components as the boiler efficiency, turbine generator performance, condenser performance, and heat exchanger performance. It will prepare log sheets by printing computed or corrected readings of up to 100 selected variables. It will monitor conditions of the plant equipment, automatically alarm, and take suitable operating action whenever these variables deviate from the limits and print out the name of the equipment in trouble, the reading, and the time of trouble. It will print any or all readings or results of calculations as demanded.

Draws Trends

A three-pen trend recorder will draw trends of any three selected variables. The computer will check its own accuracy and detect shorted dc and ac analog input elements. Upon detection of the trouble, it will sound an alarm and print out the reason for the alarm and its identification. The computer will remember readings of as many as 30 significant plant variables for at least 15 min. As readings are taken at 20-sec intervals, the computer's memory will have to retain as many as 1,350 readings at one time.

Speeds Man's Thinking

The computer is another tool for obtaining more nearly optimum efficiency, safety, and reliability in the operation of a steam electric generating plant. Its advantages are its continued performance of routine repetitive tasks, its rapid response, its deductive and compensating reasoning, and its ability to handle highly complex operations involving many tasks. It gives man an opportunity to do his thinking at a rate that he can do it best and have it applied quickly when needed. Of course, the computer will perform no better than the information programed in it.

With computer operation come new problems with more equipment which must be maintained and engineered. Attendant advantages

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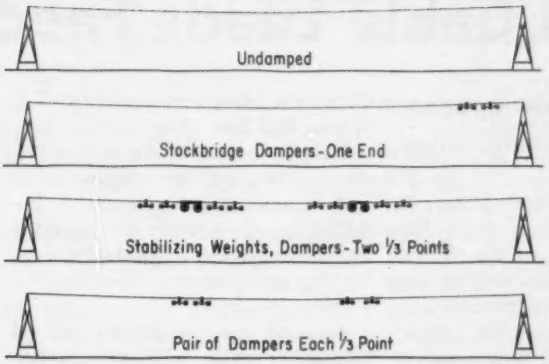
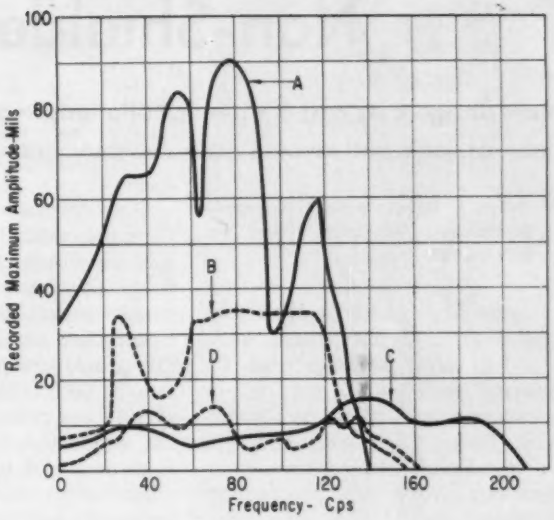


INSTALLATIONS tested had undamped span, damped span, mid-span weights and dampers, mid-span dampers only



AMPLITUDE of vibration varies with the method of damping on equivalent crossing conductor

In-Span Damping Cuts Vibration

Scheme for shortening not actual but the effective span length, Alcoa Lab finds, solves river crossing problem

C. B. RAWLINS, Alcoa Research Laboratories, Electrical Engineering Division, Massena, N. Y.

An in-span damping system can diminish greatly aeolian vibration on the conductors of a long river crossing. Alcoa Research Laboratories attributes this diminution to the shortening of the effective span length and bases its conclusion on tests with various combinations of damper spacing on test spans at Massena, N. Y.

Aeolian vibration, a problem on lines of various sorts, is particularly acute on long river crossings. Standard damping arrangements effective on most overland spans are sometimes not adequate for long crossings. Thus elaborate damping schemes, tailored to fit such installations, sometimes have not been fully effective.

Damping long crossings is difficult because:

1. Tensions are usually high, reducing the internal damping of the conductors.

2. Winds blowing parallel to the river generally contain little turbulance, there being a lack of physical obstructions to smooth wind flow at the crossing spans' elevation.

3. The length of river spans puts a greater dissipative load on the damping apparatus at span ends than in the normally shorter overland spans.

To a certain extent, the design of special dampers and damping arrangements can compensate for the effects of these factors. Yet their combined effect at times has been enough to make the achievement of satisfactory protection doubtful by prevalent techniques.

Herein lies the problem: As span length increases, the vibration power imparted to the span by the wind increases in almost direct proportion. Dampers at span ends remove this power by absorbing some of the energy of the vibration waves during their reflection at the towers. The efficiency of dampers in absorbing energy from vibrating conductors has a theoretical limit of 100%— complete absorption. The practical limit, however, is lower and cannot be raised by simply adding more dampers.

Thus, on long enough spans the energy that can be absorbed by the dampers may be less than the amount the span receives from the wind. Vibration amplitudes then may build up to levels that bring fatigue failures.

The Alcoa approach to this problem was to shorten not the actual but the effective span length. One system worked out by the laboratories was to install stabilizing weights at one or several points in the long span and to apply normal damping arrangements adjacent to these weights as though they were towers.

Proper or predictable operation of dampers requires their installation near a point of wave reflection, so that their location with respect to nodes can be predetermined. Sup-

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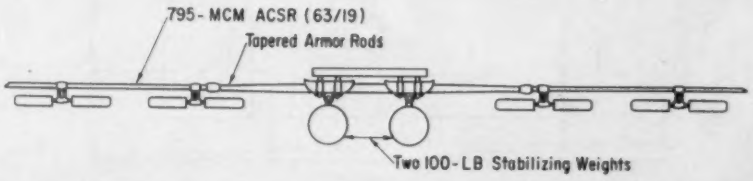


INSTALLATION gave results charted above as Curve C, which with Curve D indicated less vibration when effective span is shortened by factor of three

Non-Shielded Cable Leads Feed

New design cuts cost $5 per installation, improves appearance of jobs and avoids pole replacements in many cases

KENNETH L. MENK, Senior Engineer—Distribution, Alabama Power Co, Birmingham, Ala.

Based on six years of experience and about 200 installations, non-shielded cable is being used for primary leads on 12 and 13.2-kv transformer installations on the Alabama Power Co system. This type of installation reduces initial investment, avoids pole replacement in some cases, saves rearranging secondaries and services, permits installations near buildings where 12-kv open wire could not be used under code requirements, and facilitates the addition of load on a 12 or 13.2-kv circuit built over 4 kv.

Field test results encouraged expanded use of these cables in 1958 to all districts. This specification developed then for the cable is still current:

"One conductor No. 6 copper, 7 strands with semi-conducting tape over conductor, 250 mils heat and light stabilized polyethylene with carbon black added, meeting requirements of Appendix P of IPCEA Standards S-19-81 and ASTM specifications D-1351, and 4/64 in.-PVC jacket meeting requirements of Appendix J of IPCEA Standards S-19-81 and ASTM specifications D-1047, non-shielded, for use on 15-kv grounded neutral transformer leads".

Only two failures have occurred since use of the 15-kv non-shielded cable was expanded to the entire state. The first was on one of the original installations which had oil-base-rubber insulation. The other failure was caused by faulty installation; the cable was bent too sharply and pulled too tight against the fibre conduit, compressing the insulation. Such failures can be prevented by proper instruction of personnel making the installations.

The 15-kv non-shielded cable is more costly than open wire where transformers are installed above the secondaries. But where the transformers must be mounted below secondaries, the use of cluster mounting brackets and 15-kv non-shielded cable costs about $5 less per installation than crossarms with open-wire leads on extension pins. In addition, the cluster mount with non-shielded cable can be used in many cases without replacing a pole where the crossarm installation might require a higher pole. The cable-type installation also avoids the hazards of open-wire construction and makes a much neater installation.

The greatest initial savings from 15-kv non-shielded cable leads are realized when:

1. Pole changeouts are avoided where clearance requirements prevent lowering secondaries or where the area is being converted from 2.4 or 4 kv to 12 or 13 kv.

2. It saves expensive rearrangement of secondaries and services.

3. Transformer banks can be installed in alleys close to buildings where open-wire down leads cannot be used because of code requirements.

4. Load can be added to 12 or 13.2-kv circuits on poles where the leads must be brought down through a 4-kv circuit. This can save expensive conversions as 2.4 and 4-kv facilities become overloaded.

Extends 4-Kv Practice

Non-shielded 5-kv cable had been used extensively on 2.4 and 4-kv transformer installations to eliminate open-wire jumpers. Cable connections became particularly important when cluster mounting was developed. But cable-connected transformers were too costly for 12 and 13.2-kv systems because they required stress cones or potheads. This prompted Alabama Power to promote development of a non-shielded cable that could be used without special terminations on 12 and 13.2 kv.

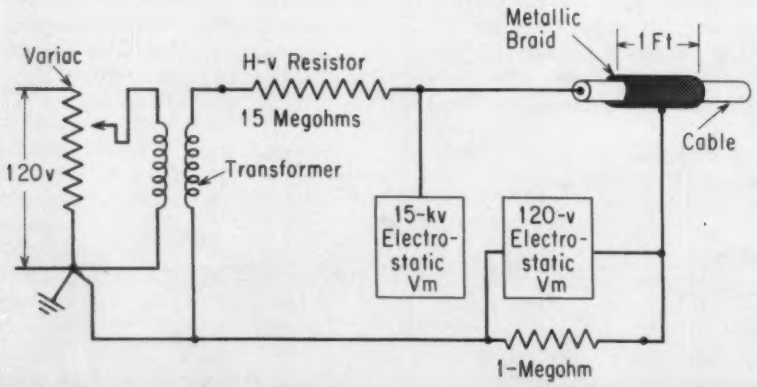
Initial inquiries in 1954 for non-shielded 15-kv cable brought only negative responses. But in December of that year one manufacturer offered a 15-kv cable that had been developed for paralleling two transformers on one pole for another utility. Specifications for this cable were:

"No. 6, 19-strand, tinned copper with semi-conducting tape over the conductor, 19/64-in. butyl rubber insulation, 5/64-in., low-SIC, neoprene jacket."

A 200-ft sample of this cable was purchased in July 1955 and tested as follows:

1. A 10-ft length was suspended in air and energized at 10 kv ac. As a precaution, a 10-megohm resistor was connected in series with the cable. No shock could be felt with the bare hand at this potential, but a slight "fuzz" could be felt when the back of the hand was held close to the cable.

2. Surface leakage was checked, using the circuit shown in the



LEAKAGE CURRENT at operating voltage checks contribution to safety

sketch. Leakage at 6.7 kv was 120 μamp per ft. This was full scale for the microammeter so voltage was not increased.

3. Dc at 75 kv was applied to the cable with both ends suspended in air and the bottom of the U resting on the ground. (75 kv was the maximum voltage available at the time; later the tests were extended to 105 kv dc without breakdown.)

Following these laboratory tests, a number of trial installations were placed in service, the first in July 1955.

Shortly thereafter, seven cable manufacturers asked to participate in the experimental program and submitted ideas for cable. Five of the seven recommended butyl-rubber insulation ranging from 19/64 to 27/64 in., with neoprene jackets either 5/64 or 6/64 in. One recommended 24/64-in. oil-base-rubber with an 8/64-in. jacket and another, 16/64 in. of natural polyethylene with a 4/64-in. polyvinyl-chloride jacket. Five-hundred-foot samples were purchased and given the same tests as the first sample. Surface leakage varied from 85 to 120 μamp per foot.

Trial installations were made in three areas of the state to get the widest experience with the least number of installations. The Mobile area was selected for damp, Gulf

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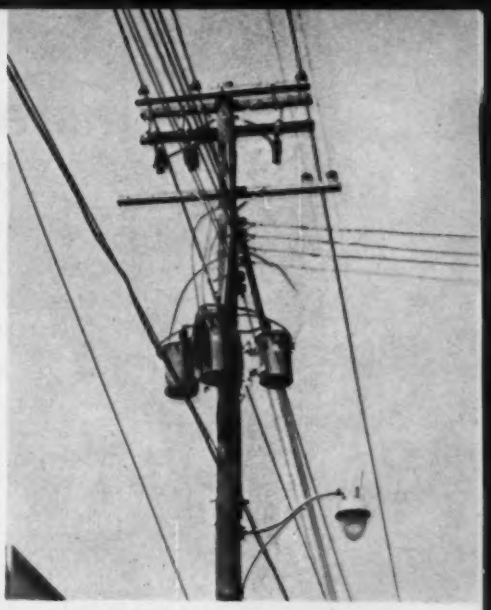
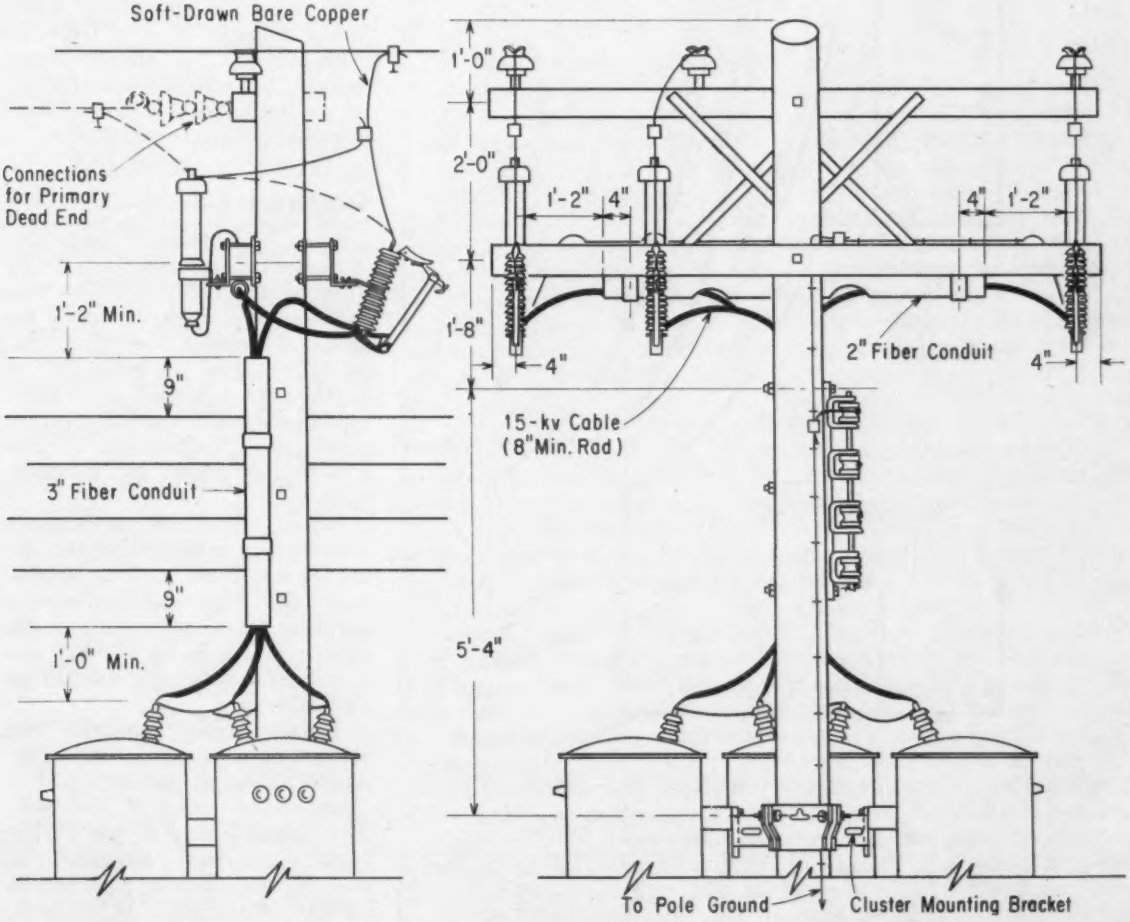


PRIMARY LEADS to transformers, non-shielded 15-kv cable in fiber conduit



CONSTRUCTION STANDARD shows use of non-shielded cable in fiber conduit for primary leads to cluster-mounted transformers to 167 kva. Minimum bends are 8-in. radius and conduit must be sawed (not broken) to length

Installs Relaying for High Load

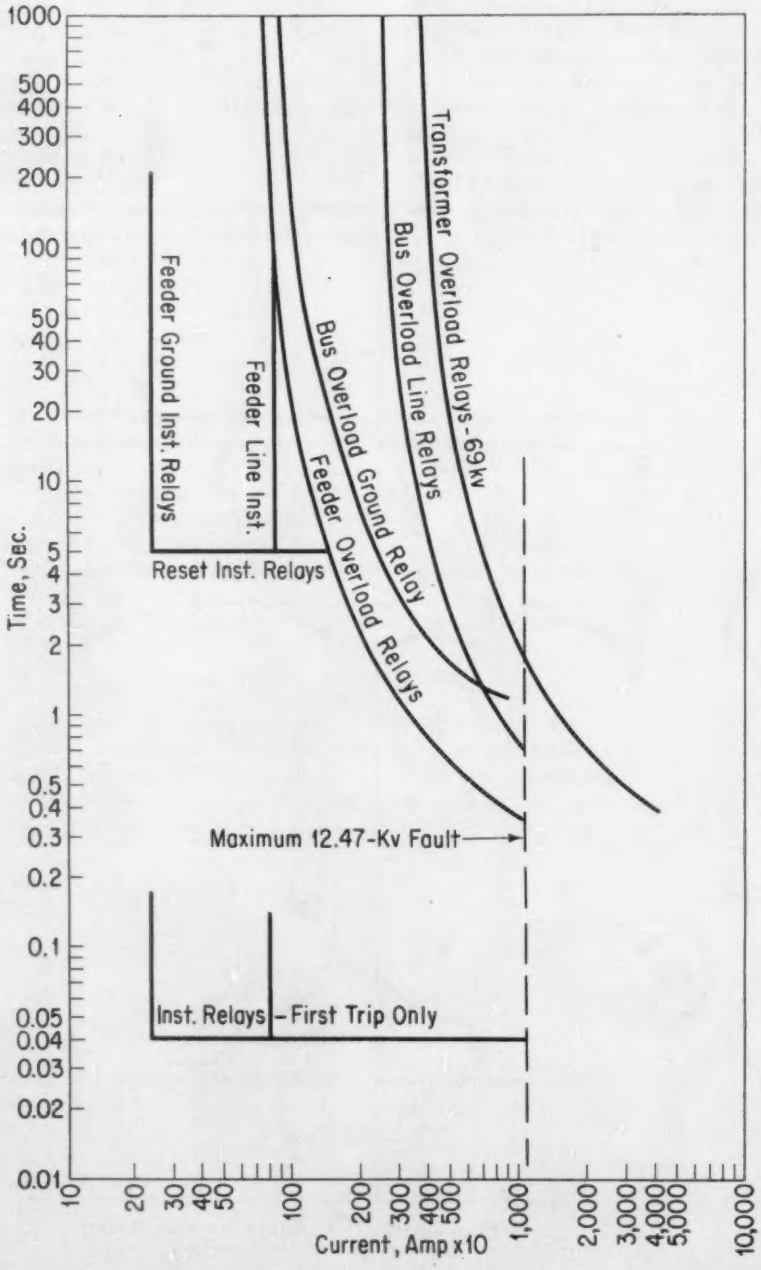
Scheme for Houston L&P 12.47-kv lines, substations with two-section buses protects 8,000-kva feeders from damage

C. S. **KAYSER**, Distribution Relay & Protection Engineer, Houston Lighting & Power Co, Houston, Texas

High-load-density feeders from substations with two-section buses are effectively protected from excessive fault damage by a relay scheme developed by Houston Lighting & Power Co for its 12.47-kv, wye, multi-ground system. The extension of such protection has paralleled the growth of the company's 12.47-kv system.

In this scheme, substation transformers are protected by differential and by high-side overload relays operating a grounding switch. The overload relays are set to carry the combined loads of both substation transformers. Each section of the 12.47-kv bus is protected by phase and ground overload relays which give back-up protection to the feeder breakers also. The feeders themselves have the protection of very-inverse overcurrent relays, instantaneous overcurrent relays, and a three-shot reclosing relay.

A time-delay relay allows transformer fuses to blow or faults to clear without the breaker being tripped. Laterals of small-conductor size are fused with links of sizes that assure blowing before conductor temperature exceeds 300C.



RELAY COORDINATION is for 12.47-kv feeders with available short-circuit capabilities of 250 to 400 Mva, but rated 8,000 kva, 12,000 kva emergency

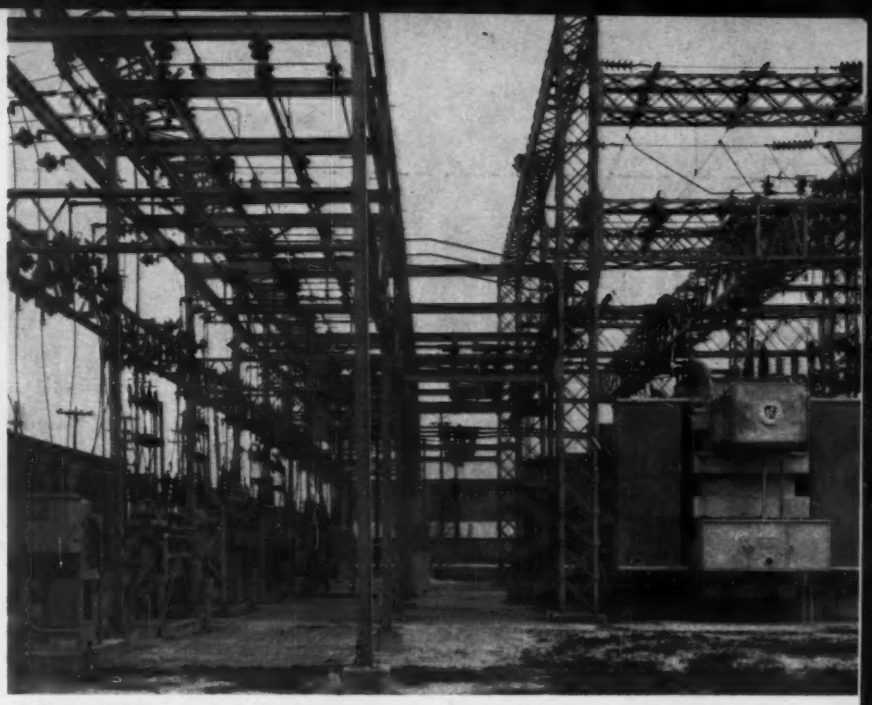
Substations Increase

Since 1950, Houston L&P substations have increased from 56 to 91 in number and from 0.3-30 Mva to 0.6-90 Mva in size, and total installed self-cooled transformer capacity has gone up from 290 to 1,578 Mva. Accordingly, interrupting duty that was 100 Mva or greater in 17 substations is now 180 Mva or greater in 29 substations.

Before 1950, all transformer capacity was paralleled on one operating bus. Now, in larger substations—30 Mva and above—the operating bus is split by a normally open-section breaker, and half the transformer capacity is installed on each section.

Today's largest substation has six transformers with a total self-cooled rating of 90 Mva and a forced-cooled rating of 150 Mva. The "indoor" bus has two 15/25-Mva transformers connected to each operating section, each section with a fault availability of 360 Mva. The "outdoor" bus has one 15/25-Mva transformer connected to each section, and each section in turn has

Densities



KIRBY SUBSTATION is operated with bus split by normally open section breaker. Its eight feeders serve an average load density of 12 Mva per sq mile and need relay protection against damage from high fault currents

a fault availability of 180 Mva.

Outside downtown Houston there are 11 50-Mva substations, each with two 25/42-Mva, 10%-impedance transformers. Each bus section in these substations has an available fault capability of 230 Mva. Each of another 13 30-Mva substations has two 15/25-Mva, 7.3-7.5%-impedance transformers. The latter are operated with the bus section breaker open, each section having an available fault capability of 180 Mva.

Five older substations of the single-bus design have three 7.5-Mva, double-rated transformers in parallel and a fault availability of 250 Mva on the bus. For the installation of any additional capacity the bus will be separated by a normally open section breaker for minimizing interrupting duty.

Substations with two-section operating buses are automatic. Motor-operated, air-break switches isolate transformers from transmission lines feeding them and from the 12.47-kv bus. In some stations, each transformer is supplied from a separate transmission line. In others, where transformers are tapped to a single line, the line is sectionalized between the transformers by a motor-operated, air-break switch.

Transformers are protected by differential and high-side overload relays which operate a high-side grounding switch. The motor-operated disconnect switches open while the line is de-energized from its remote ends. When a transmission line fails only the low-voltage switches open automatically.

In substations tapped from a single line, that line is tried once, then sectionalized between the transformers. Each line section is tried a second time before the transformer on the faulted section is disconnected from the 12.47-kv bus. After the 12.47-kv switch opens, the section breaker closes automatically to pick up all load on one transformer. The 15 and 25-Mva transformers' triple ratings provide more capacity for emergencies.

High-side, overload relays are set high enough to carry the load of both transformers, thus affording little overload protection for the transformer and little back-up protection for the feeders. For this reason, phase and ground bus overload relays are on each 12.47-kv bus section. These total the feeder load on each section. The phase relays are set for the load on one bus section only and can be set much lower than the high-side overload relays. The phase relays, along with the ground relay, provide considerable back-up protection for the feeder breakers.

Loading Is Limited

Substation loading is limited to produce less than 1% loss of life over a 4 to 5-hr outage of one transformer. Most substations have supervisory alarms for indicating a transformer outage. Others must be checked after a transmission-line outage. Should a prolonged transformer outage occur during a peak season, some load can be transferred to adjacent substations.

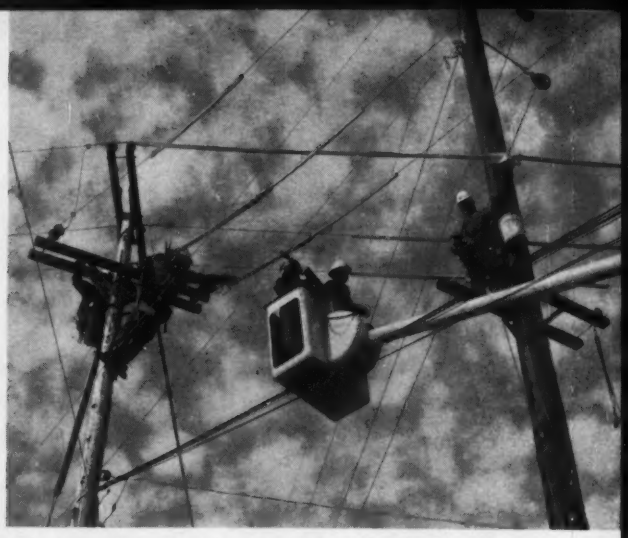
Kirby Substation is typical of the newer substations with two transformers and a normally open section breaker. The transformers are rated 25/33/42 Mva with 10% impedance based on the self-cooled rating and are equipped for LTC. Eight feeders, four on each bus section, in 1960 served about 3.8 sq miles with a peak load of 45 Mva. This is an average load density of 12 Mva per sq mile. The eight feeders vary in exposure from three to ten pole-miles of line and total 55 pole-miles. No feeder had a permanent fault that year. And instantaneous trip-outs with immediate reclosure averaged less than one per pole-mile.

Kirby Substation feeders have a relaying scheme, consisting of three induction-disc overcurrent relays with very inverse characteristics, three instantaneous overcurrent relays, and a three-shot reclosing relay. A telephone-type, time-delay relay defers the trip of the instantaneous relays from 2 to 4 cycles to allow transformer fuses to blow and other self-clearing faults to clear without tripping the breaker.

The very inverse relays trip on phase currents. As all feeders offer standby to adjacent feeders, through open pole-top switches, the relays are set to carry about 15 Mva. Two of the instantaneous relays trip on phase currents, the other on ground currents. The instantaneous phase relays are set high enough to drop out on the maximum expected load current. The instantaneous ground relay can be set considerably below the phase setting to pick up on ground faults.

(*Continued on page* 80)

Aerial Basket Proves Versatile, Economic; Fleet to Be Doubled



AERIAL BASKET CREW assists other linemen in transferring energized lines from old pole to a new one, avoiding service interruption to a large shopping center

Field tests show Consumers Power that savings pay for purchase in less than two years; crew complement studied

G. A. NEWSOM, Electric Distribution Operating Engineer, Consumers Power Co, Jackson, Mich.

Aerial baskets have proved economical to Consumers Power Co in line work, tree trimming, and street-light maintenance, the company's three years of field tests leading to its decision to expand its present fleet of 13 to 25 units.

Consumers Power's work records show that aerial baskets pay off in savings in 1.3 years or less for routine line work, in two years for tree trimming, and in 1.9 years for street-light work. These results were based on an eight-year depreciation cycle and capitalization of the difference in cost after taxes between aerial baskets and the usual equipment. Use of the units is limited only by accessibility to an installation. The company also feels that the aerial units will go far toward supplementing, but will never eliminate crews with conventional overhead line equipment.

Several Makes Tried

The company experimented in 1958 with aerial baskets for line work. Several makes were tried, and one each of three different makes was purchased. These went to the three operating centers having the most linemen. Although the units had slightly different operating characteristics, all models had baskets over the cab in the travel position to facilitate positioning of the truck for minimum boom movement in handling most jobs. Placement of the pedestal directly behind the cab clears the truck bed for carrying material.

Two outriggers help to keep the truck bed clear. They permit a working height of 53 to 55 ft, and a horizontal reach of 32 to 34 ft at a 22-ft working level. This last feature permits mid-span repairs on ACSR conductors in rural areas with the truck remaining on the roadway.

Line truck bodies without the superstructure go with the aerial equipment. Entrance is from the rear or from the curb side just to the rear of the boom pedestal. The outriggers at the pedestal form a vertical triangle when they are lowered. Ball check valves on hydraulic lines prevent collapse if hydraulic tubing bursts, and an interlock between the boom and outriggers keeps the boom from being raised before the outriggers are down and under pressure on the ground. The upper boom originally had 60-kv insulation and the baskets were Fiberglas. More recently, the upper booms are Fiberglas with 100-kv insulation.

Working Lineman Is Belted

By means of fastenings on the inside of the basket, a lineman is belted while he works. Linemen work from the baskets with rubber gloves on voltages through 8.32 kv to ground and with hot sticks at higher voltages. Working barehanded from a basket at line potential has not been attempted.

In 1960, Consumers Power used 13 aerial units, including three hydraulic ones for electric line work. It used three for three trimming, and seven for group replacement of street-light bulbs. By the end of 1961, the company will have added five hydraulic aerial baskets for line work, five others for tree trimming, and two for street light work. All are alike, except that those for line work have a front-end winch and baskets for two men.

A line-work base crew has a lead lineman, a Lineman A, and, occasionally, a third man to handle special jobs. Crews rotate so that all linemen become familiar with the equipment.

During the field tests, the base-work assignment was in two categories: Jobs for the basket crew only, and basket-crew assistance to other crews. Work accomplished was evaluated in two ways. Installation or removal times were compared with time taken by crews employing conventional methods. Jobs were discussed

TRANSFORMERS as heavy as the 10-kva class can be delivered to the pole with the boom and eased into position for installation, the latter involving only two men

TRANSFORMER on pole in a swamp is changed out by men working from an aerial basket. Boom length permits the special line truck to remain in the roadway

with the workmen and their supervisors. By these means it was established on which jobs the most money was saved.

Operating statistics were developed for two types of work. A large operating division with a full-time (two-to-three year) schedule of specialized tasks can cut out automatic sleeves (mid-span) on heavily loaded primary distribution circuits and install compression sleeves with the conductor energized. The aerial basket is especially adapted to this work and during the first year saved many man-hours of labor. The aerial basket was paid for in four months.

Basket Proves Versatility

Another large operating division had a good over-all routine work program. Its experience proved helpful in the decision to expand the aerial equipment and showed that the aerial basket proved of assistance to other crews about 25% of the time. Many kinds of jobs have been handled. Typical work by the two-man basket crew included installation or removal of load meters on primary and secondary lines; cutting of secondary wires around tree limbs; and, inspection, repair, or cleaning of potheads, switches, substation equipment, and insulators on circuits through 138 kv. Work in mid-span includes repair of frayed conductor and replacement of bolted or automatic splices with compression splices.

In primary-circuit balancing work, corner jumpers and transformer feed taps were changed. Other work covered changing of transformer taps, house moving jobs, and removal of foreign objects from energized lines. At broken poles and pole fires, the aerial crew has cleared trouble and then assisted in final repair.

A two-man aerial crew has put up and removed all mast arm installations, even 16-ft units, along with conductors, racks, photoelectric controls, and deadends for street-light jobs. The crews have handled all equipment for primary and secondary extensions, except the poles. The front-end winch has raised pole-mounted distribution transformers heavier than the 10-kva class. Other construction jobs covered installation of wall-line secondary, mid-span service taps, capacitors, and primary metering.

On one project, the aerial-basket crew removed two fuse cutouts, an arrester, two transformers—5 and 15 kva—, two spans of three No. 4 secondary, three primary crossarms, ground wire and molding, one three-point and six one-point racks, three down guys and anchor rods, 24 secondary deadends, and one primary deadend.

To be installed were 12 secondary and one primary deadends, with the splicing out of two spans of three No. 6 secondary and transfer of four spans of three No. 6 secondary to deadend on a new pole. One No. 4 primary ground was transferred to the new pole and jumpers were installed to keep the primary ground working in two directions during transfer of the secondary, which had the primary ground for neutral.

As estimated from the work measurement study, this project would have taken the usual crew 29.5 man-hr. Total time for the two-man aerial-basket crew was 4.1 hr, or 8.2 man-hr. In "assist" work, the aerial-basket crew has raised primary lines to a higher gain, moved primary lines from an old pole lead to a new one 30 ft away, and spliced out and re-deadended primary, all with the primary energized.

Demands for Assistance Continue

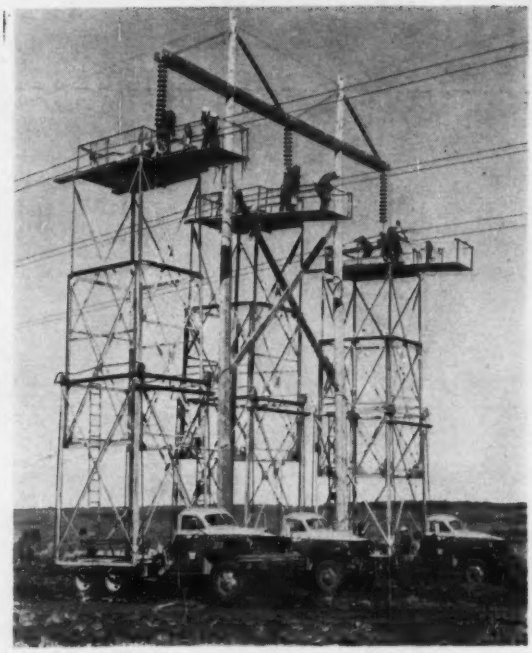
Assisting in construction, the aerial crews have strung secondary through trees, primary over trees using a bull line, and primary over busy intersections or across energized primary where a temporary pole would have been required. They have dismantled overhead lines and handled primary work on congested poles where much "rubbering up" for climbing would have been needed. They have installed and removed rigging and adjusted spacers for spacer-type cable.

Late this year, new equipment will be placed in headquarters with smaller crew concentrations, and an additional unit will go into one area for specialized work. Demands by other crews for assistance now hamper basket crews in keeping up with their own work.

ELECTRIC UTILITY METHODS

Eum

CONSTRUCTION & MAINTENANCE



PLATFORMS permit crew to armor rod and clip in a span every 15 min—half time required using ladders

Telescoping Platforms Speed Up Transmission Line Construction

J. F. **SERVIS**, Supt of Construction, Idaho Power Co, Post Office Box 770, Boise, Idaho

Telescoping-type elevated platforms mounted on truck beds are being utilized by Idaho Power Co to raise men up to a working level under transmission tower crossarms. By using three such rigs at a time, the crew can armor rod and "clip in" all three phases of bundled conductor at a structure in 15 min—half the time required working from hanging ladders.

Idaho Power is averaging two miles/day of line, strung, sagged, armor-rodded, "clipped in" and spaced, by using the platforms and other modern stringing techniques in building its new 230-kv transmission line between Boise Bench Substation and Brady Substation at American Falls, a distance of 187 miles. Most of the route is over rolling sagebrush hills with some cultivated land. Due for completion this fall, the line is believed to be one of the longest bundled conductor installations on wood structures in the United States.

In addition to 1,544 wood structures, there are 17 steel towers at the Boise end and two steel towers at American Falls. The typical wood tangent structure is two-pole "H" frame with 3¾-in. x 9¾-in. x 40-ft double-plank crossarm, also plank "X" braces and "K" braces. Pole spacing is 19 ft, 6 in., average height 70-ft Class 2, with 750-ft ruling span and medium loading.

The conductor, which is bundled on 16-in. centers, is 715.5 MCM, 24/7 ACSR (Stilt), weighing 921 lb/1,000-ft, 1.036-in. diameter, received in 10,000-ft lengths on 84-in. metal reels. The two shield wires are ⅜-in. EHS galvanized steel, also on 10,000-ft reels. A double string of seventeen 35,000-lb, 10-in. disc insulators are used on deadend structures. Fifteen such insulators are used in a single string on running angles and thirteen 15,000-lb, 10-in. disc insulators are used on tangent structures.

Except in areas where numerous transmission and distribution crossings are encountered, only the center phase is tension-strung. Conductors for both outside phases are laid off on the ground, or lagged where terrain is rocky, by "paying off" from two reels mounted on each of two 6-wheel drive trucks. These outside conductors are placed in two separate neoprene-lined stringing sheaves attached to an equalizer yoke-plate, which is attached to the string of suspension insulators, and the whole assembly is then raised by power-wagon winch line to the end-phase fitting of the crossarm. A rope tied from the inside sheave to the pole effectively keeps the assembly from twisting as the conductors are pulled to sag later.

When the outside phases are raised, a triple sheave block is installed with a "tag" line for the center phase. The "tag" line is a single herringbone nonrotating wire rope that is attached to the two conductors through an articulated running board which places the conductors properly spaced into the outer sheaves of the block. Using Pengo Pullers and Tensioners, the two center-phase conductors are "back-pulled" in 10,000-ft reel lengths under light tension.

Except at the infrequent deadends, conductors are sagged in 20,000-ft lengths (2 sets of reels). Each pair of conductors is sagged simultaneously under careful control, with the help of three pole-mounted transits at three separate locations along the 20,000-ft section. Most of the armor rodding and "clipping in" is done from the elevating platforms. At the end of a pull, 400-ft snubbing cables are attached to the suspension shoes as a means of holding unequal tension until creep occurs.

Standard Reels Aid Aluminum ACSR Handling

Table I—Dimensions of Standard Reels, Inches

Reel Designation	Reel Capacity Cu In.	Flange Diam	Drum Diam	Width Inside	Width Outside	Arbor Hole Dia
NR 30.22	9,950	30	18	22	25	2¾–3
NR 36.22	16,800	36	18	22	25	2¾–3
NR 38.22	18,000	38	20	22	25	2¾–3
NR 42.28	29,100	42	21	28	32½	2¾–3
NR 48.28	38,000	48	24	28	32½	2¾–3
NR 60.28	61,900	60	28	28	32½	2¾–3
NR 66.28	76,000	66	30	28	32½	2¾–3
RM 66.32	76,900	66	36	32	38	2¾–3
RM 68.38	99,300	68	36	38	44	2¾–3
RMT 84.36	122,100	78(84)	42	36	43	5–5¼
RMT 84.45	152,700	78(84)	42	45	52	5–5¼
RMT 90.45	187,000	84(90)	42	45	52	5–5¼

Prefix "NR" denotes wooden nonreturnable reel, "RM" metal returnable reel and "RMT" metal returnable reel with I-beam tires.

Pay off equipment for NR48.28 and smaller should be 2 in. wider than outside reel width to clear bolts and flange distortion. For NR60.28 and larger, it should be 4 in. wider.

These standards for reels are excerpted from *Tentative Packaging Standards for Bare Stranded Aluminum Conductor and ACSR*, an eight-page booklet now being distributed by the Aluminum Association, 420 Lexington Ave, New York 17, N. Y. The standards list 12 reels, which accommodate all standard types of bare stranded aluminum electric conductor and ACSR. Seven are wood non-returnable reels, five, metal returnable. The complete tables cover wire sizes from No. 6 to 3,500 MCM. Electric utility purchasing agents are receiving the booklet via mail.

Table II—Standard Packages for ACSR

Conductor			Alternative Standard Packages								
Code Word	AWG or CM	Strands Al/Steel	Reel	Lb per Reel	Ft per Reel	Reel	Lb per Reel	Ft per Reel	Reel	Lb per Reel	Ft per Reel
Turkey	6	6/1	NR 30.22	590	16,340						
Swan	4	6/1	NR 36.22	885	15,420						
Swanate	4	7/1	NR 38.22	1,200	17,910	NR 30.22	600	8,955			
Sparrow	2	6/1	NR 42.28	1,770	19,390	NR 36.22	885	9,695	NR 30.22	590	6,465
Robin	1	6/1	NR 42.28	1,770	15,360	NR 36.22	885	7,680	NR 30.22	590	5,120
Raven	1/0	6/1	NR 42.28	1,770	12,190	NR 36.22	885	6,095	NR 30.22	590	4,060
Quail	2/0	6/1	NR 42.28	1,770	9,670	NR 36.22	885	4,835	NR 30.22	590	3,220
Pigeon	3/0	6/1	NR 42.28	1,770	7,670	NR 36.22	885	3,835	NR 30.22	590	2,560
Penguin	4/0	6/1	NR 42.28	1,770	6,080	NR 36.22	885	3,040	NR 30.22	590	2,025
Waxwing	266,800	18/1	NR 66.28 RM 66.32	4,160	14,360	NR 48.28	2,080	7,180	NR 42.28	1,385	4,785
Chickadee	397,500	18/1	NR 66.28 RM 66.32	4,160	9,630	NR 48.28	2,080	4,815	NR 42.28	1,385	3,210
Ibis	397,500	26/7	RMT 84.36	7,590	13,870	NR 60.28	3,795	6,935			
Lark	397,500	30/7	NR 66.28 RM 66.32	4,970	7,980						
Kingbird	636,000	18/1	NR 66.28 RM 66.32	4,160	6,020	NR 48.28	2,080	3,010	NR 42.28	1,385	2,005
Grosbeak	636,000	26/7	RMT 84.36	7,590	8,670	NR 60.28	3,795	4,335			
Scoter	636,000	30/7	NR 66.28 RM 66.32	4,970	5,005						

Table III—Standard Packages for EC Aluminum Conductors

Conductor			Alternative Standard Packages								
Code Word	AWG or CM	Strands	Reel	Lb per Reel	Ft per Reel	Reel	Lb per Reel	Ft per Reel	Reel	Lb per Reel	Ft per Reel
Peachbell	6	7	NR 42.28	1,400	56,910	NR 36.22	700	28,455			
Rose	4	7	NR 42.28	1,400	35,710	NR 36.22	700	17,855			
Iris	2	7	NR 42.28	1,400	22,470	NR 36.22	700	11,235			
Pansy	1	7	NR 42.28	1,400	17,830	NR 36.22	700	8,915			
Poppy	1/0	7	NR 42.28	1,400	14,130	NR 36.22	700	7,065			
Aster	2/0	7	NR 42.28	1,400	11,210	NR 36.22	700	5,605			
Phlox	3/0	7	NR 42.28	1,400	8,890	NR 36.22	700	4,445			
Oxlip	4/0	7	NR 42.28	1,400	7,050	NR 36.22	700	3,525			
Daisy	266,800	7	NR 42.28	1,400	5,590	NR 36.22	700	2,795			
Laurel	266,800	19	RM 66.32 NR 66.28	3,800	15,170	NR 48.28	1,900	7,585	NR 42.28	1,265	5,055
Canna	397,500	19	RM 66.32 NR 66.28	3,800	10,180	NR 48.28	1,900	5,090	NR 42.28	1,265	3,395
Cosmos	477,000	19	RM 66.32 NR 66.28	3,800	8,490	NR 48.28	1,900	4,245	NR 42.28	1,265	2,830
Syringa	477,000	37	RMT 84.45	7,400	16,530	RM 66.32 NR 66.28	3,700	8,265	NR 48.28	1,850	4,135

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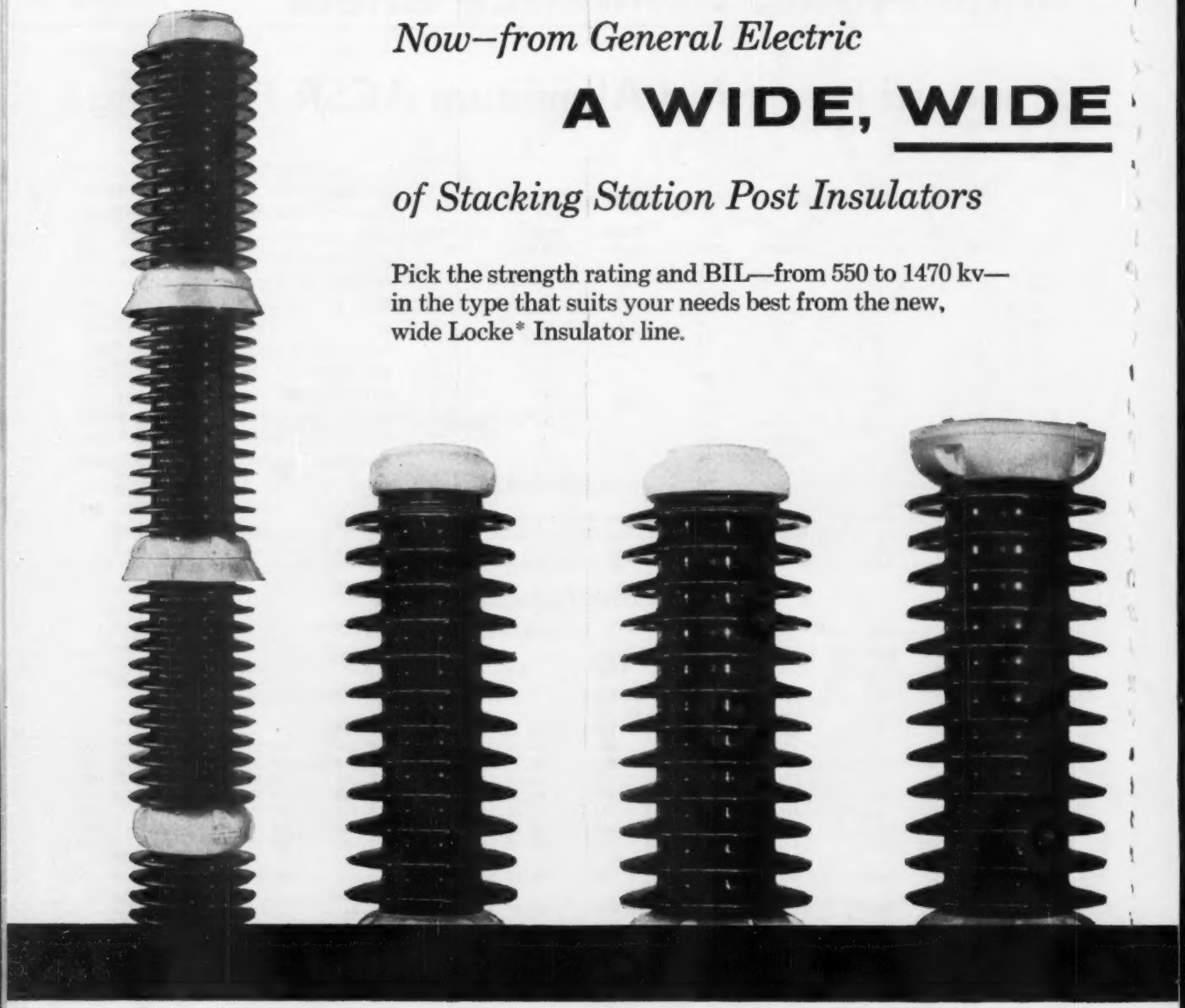

Type A

Made to General Electric's exacting product standards and proved under rigid mechanical and electrical strength test procedures. Available in standard, high and extra-high strength ratings.

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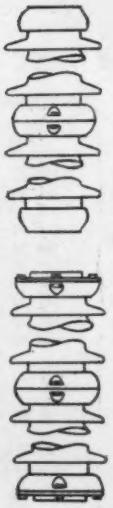
Completely interchangeable, each unit can be used anywhere in the stack. Use 2, 3, or 4 units to get the BIL you require. The adapters for top and bottom of stacks allow quick, easy installation on switches . . . as bus supports . . . anywhere. Type B units used with adapters meet standard stack heights. Available in standard, high and extra-high strength ratings.



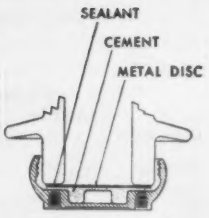


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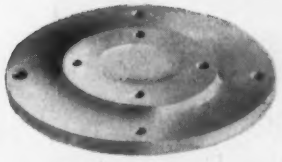
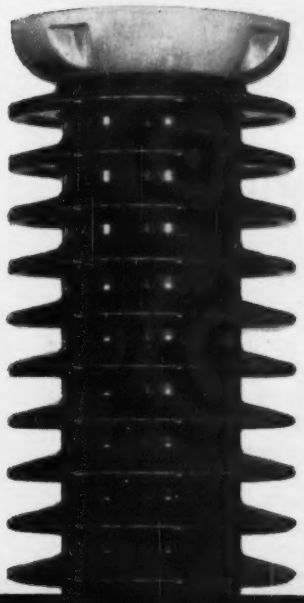
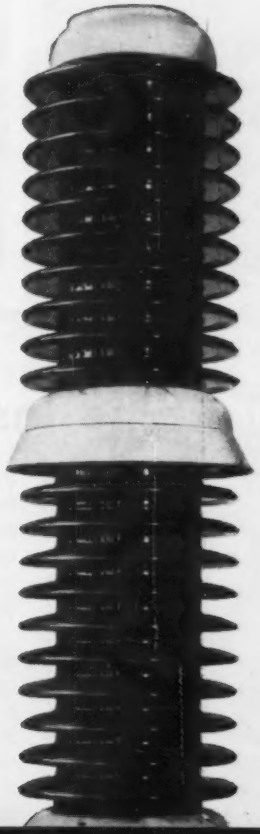
Illustration shows insulator taken out of service after six years and returned for laboratory tests. Removal of cap and cement revealed no deterioration of metal disc. Perfectly sealed system for forcing gas into porcelain cavity was set up. Even under 10 p.s.i. pressure, "sniff" tests were negative, proving seal completely effective.

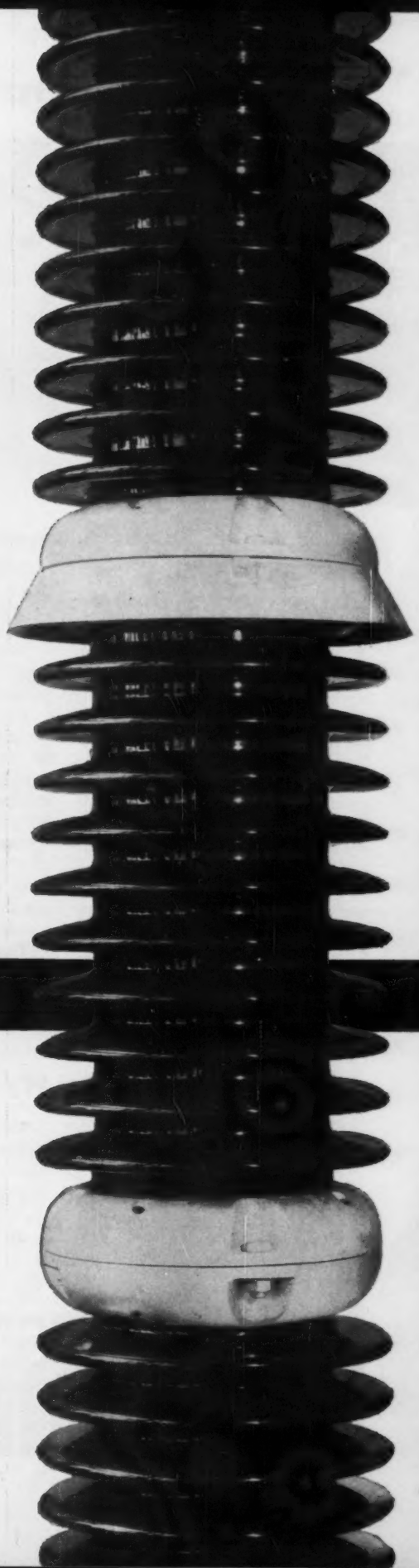
SELECTION



ADAPTER PLATE







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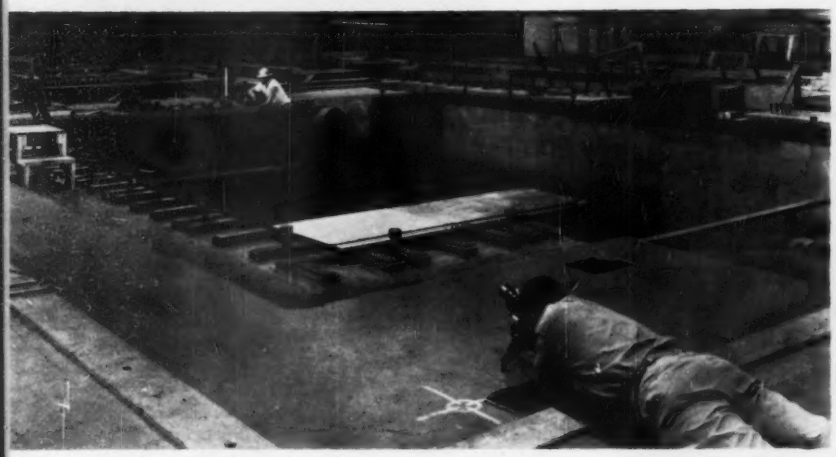
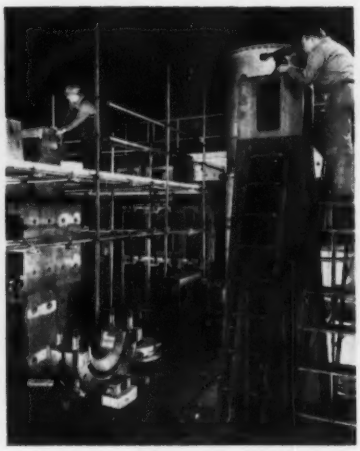
News of Manufacturers





Optical alignment, plus factory-recorded data, eliminate "cut and try" adjustments, as . . .

New Techniques Cut Turbine Installation Time

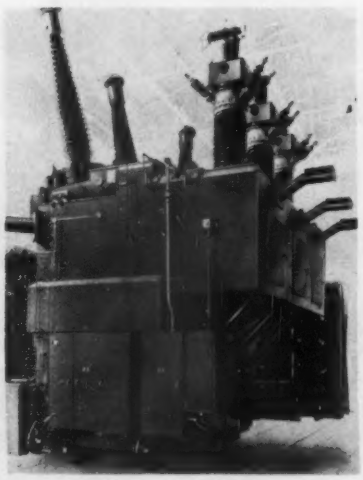
Allis-Chalmers Manufacturing Co reports that new techniques using precision optical tooling and the latest in turbine-generator test facilities have been combined to cut unit installation manhour costs up to 34%. Furthermore, factory-field coordination from test pit to foundation is said to result in absolute installation precision.

Steam chest, main stop valves, reheat control valves, oil tank assembly, and generator coolant and scavenging equipment can be completely tested as separate components and installed at the power station before major turbine and generator assemblies are delivered.

This time-saving technique can be utilized, it is reported, by the use of modern turbine and generator manufacturing test facilities. The turbine facility is complete with integral steam, oil and condensing systems, as well as instrumentation and control apparatus. Therefore, most piping systems and other below-floor equipment are not required for factory test runs.

Test pits also permit use of precise optical leveling equipment to establish a level reference plane from which factory assembly of the turbine takes place. With the same instruments, a corresponding plane can be established at the job-site foundation before major components arrive.

Installation engineers, using optical alignment methods and recorded clearances from the factory, reassemble the unit in the field as it was in the factory. Costly "cut and try" job-site adjustments are eliminated. The new time-saving technique is applicable for installation of all reheat-type turbine generators.



HV Tap-Changer Transformers for Con Ed

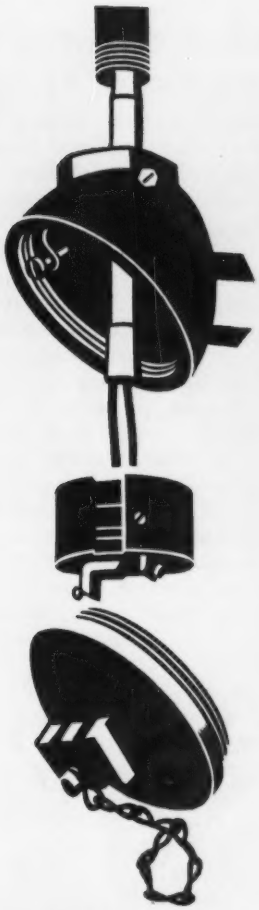
Two Westinghouse Electric Corp autotransformers with type URH high-voltage tap changers will be installed at the Consolidated Edison Co's Dunwoodie substation, connecting the existing 138-kv system to the new 345-kv system, stretching across New York State.

Con Ed's specifications called for a triple rating—180,000/240,000/300,000 kva, ±12% voltage variation on the high-voltage winding by load tap changing, a sound level of no more than 60 db at 180,000 kva, and a shipping weight not exceeding 420,000 lb.

One series transformer is eliminated by the use of a type URH high-voltage tap changer to achieve the voltage variation on the high-voltage winding. This reduces the size of the transformer and improves the over-all efficiency of the unit. Increased tap changer contact life is said to be achieved by an inphase resistance-type transfer switch.

The over-all unit dimensions are: 37 ft long, 32 ft wide, and 33 ft high. Individual shipping weight is about 420,000 lb, and when installed, the total weight will be 775,000 lb.

(*More News of Manufacturers, p 56*)



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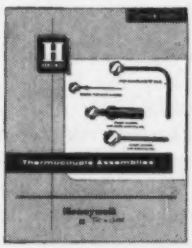

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*Determines ductility of wire and adherent quality of galvanizing.

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Muncie, Indiana

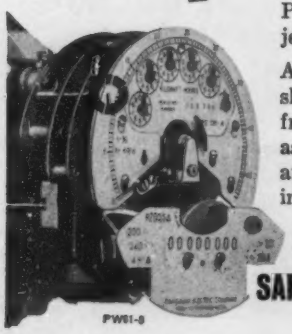
with Sangamo Dual Range Mechanical Demand Registers

Sangamo DR registers improve metering accuracy, keep pace with load growth, reduce register change-outs, and cut inventory costs by reducing the number of meters and registers you need to stock.

The Sangamo dual range (DR) mechanical register has a "flip-over" scale plate that permits rapid in-the-field range changes while assuring positive interlock between scale and range selected. It is available for singlephase and polyphase watthour meters in both universal and standard scales.

A range change is accomplished by simply loosening (not removing) six screws and reversing the scale plate. Only one gear moves, and the register does not require readjustment after the change---accuracy is always ±1% of full scale. Polished, hardened stainless steel pivots and jeweled bearings maintain the high accuracy.

And in the DR, you can rely upon the Type H slow speed, high torque motor to remain trouble free. Sangamo's gravity reset action further assures dependable, maintenance-free performance. Your Sangamo Representative has other important information about the DR.



PW61-8

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Hollow Conductors Permit Large Motors' Air Cooling

Eight English Electric motors using hollow conductor rotors (four rated at 6,200 hp and four at 2,560 hp) were recently commissioned for driving the main boiler-feed pumps at two plants belonging to Britain's Central Electricity Generating Board. Hollow conductor rotors are being used by English Electric to provide direct air cooling for high-speed, large slipring motors.

Designed primarily for driving boiler-feed pumps, these motors can also be used for other high-speed applications requiring speed variation and/or a low starting current.

The new English Electric design is reported to resolve effectively the cooling problem inherent in large variable speed drive/high-pressure, boiler-feed centrifugal pump applications.

For these applications, the slip-ring motor has the advantages of low cost, simple control and low starting current. However, providing good cooling for the end windings, while retaining adequate mechanical support, has in the past been a problem.

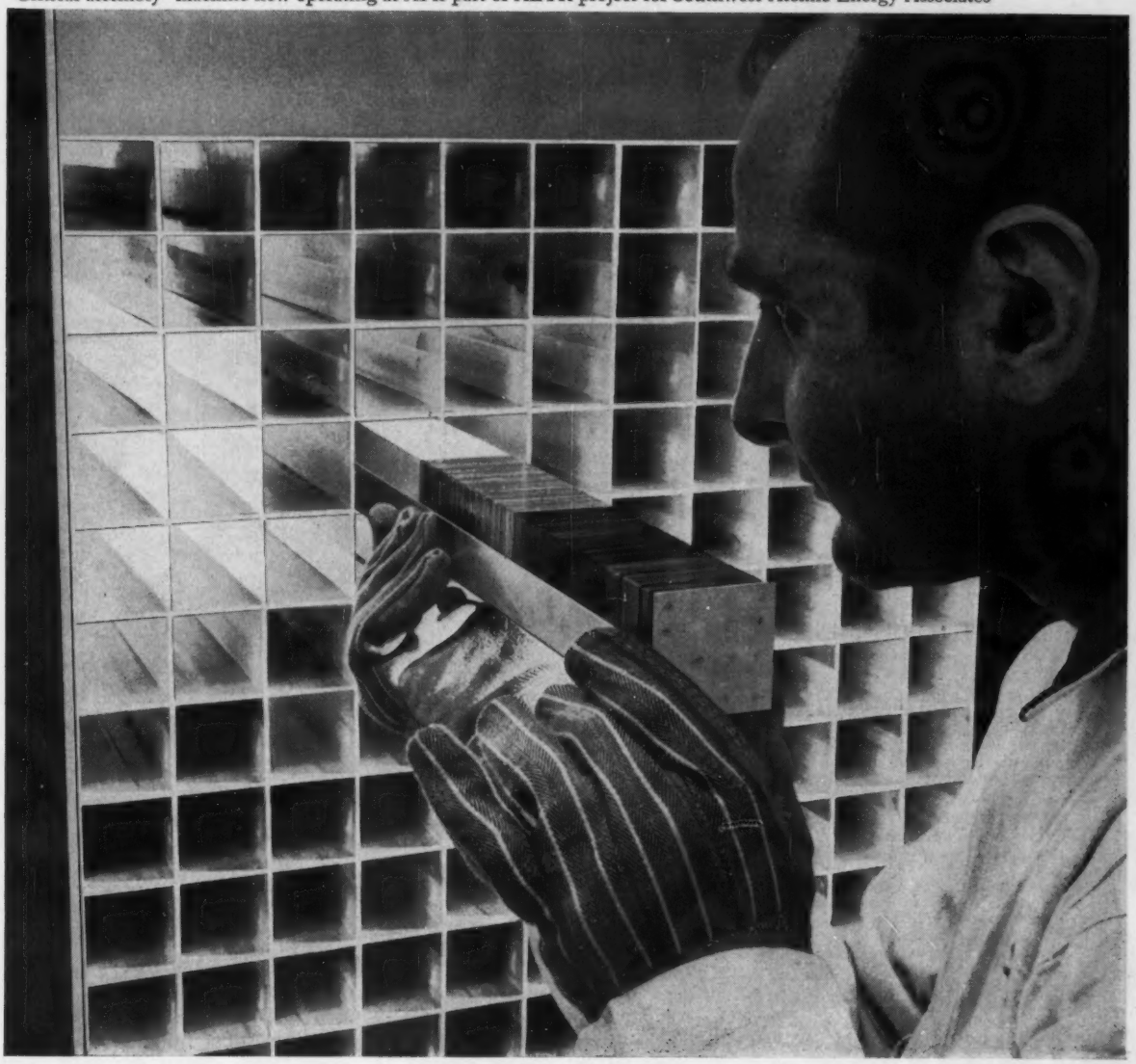
English Electric's solution has been to allow air to enter at both ends of the conductors, which are made from hollow rectangular section copper. This is said to keep the end windings cool and at the same time reduce to a minimum the quantity of cooling air required.

MANUFACTURERS BRIEFS

• **Southern States, Inc,** is the new name for Southern States Equipment Corp, of Hampton, Ga. For 44 years the company has been known as "Southern States" throughout the industries it serves and it believes this to be a more descriptive and concise company name.

• **Multi-Amp Electronic Corp** has completed its move to new, larger quarters in Cranford, N. J., from Union, N. J. A modern 15,400-sq-ft building on a two-acre site was constructed—about five times larger than the Union manufacturing facili-

"Critical assembly" machine now operating at AI is part of AETR project for Southwest Atomic Energy Associates



The Peaceful Atom

Needed in ten years: 100% increase in world power output

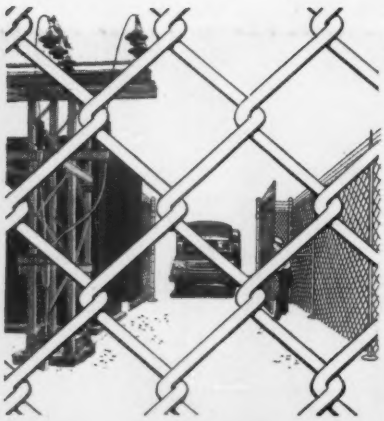
In the dynamic decade ahead, the demand for electrical power will be expanding faster than ever before. To meet this vastly increased need, new and highly advanced concepts are needed. A promising nuclear concept is the Advanced Epithermal Thorium Reactor. The AETR is under active study today by Atomics International for the Southwest Atomic Energy Associates, fifteen investor-owned utility companies. Two other nuclear concepts pioneered by Atomics International are being applied in construction of power stations in Piqua, Ohio, and Hallam, Nebraska, as part of Atomic Energy Commission programs. These are some of the ways AI is helping the power-producing companies of the world double the supply of electricity in the next ten years.

ATOMICS INTERNATIONAL

Division of North American Aviation

Pioneers in the creative use of the atom

World Headquarters: Canoga Park, California, U.S.A. Cable Address: ATOMICS. *Other Offices:* Washington, D.C., U.S.A.; Geneva, Switzerland. *Affiliated with:* INTERATOM, Bensberg/Cologne, Federal Republic of Germany and DYNATOM, Paris, France



PAGE FENCE

These 3 VALUES are important

1. QUALITY is important. When you invest in a fence you want it to last for a long, long time. When you specify PAGE you get 77 years of our experience in the design and manufacture of a quality fence. Page Fence is engineered for long-lasting service.

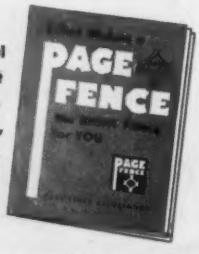
2. WIDE CHOICE is important. For example, we offer a choice of 4 chain link fabrics—ACCO-Aluminized, our latest development, or galvanized steel, stainless, or solid aluminum. Each of these has characteristics which meet individual preferences or make it more suitable to meet certain climatic or service conditions. Furthermore, there are 8 basic fence designs and 6 gate styles. No other company can serve you with so wide a selection.

3. INSTALLATION is important, too. A fence can be no better than the quality of its erection. The Page Fence Member in your locality is trained, experienced, responsible, and interested in your satisfaction.

• • •

When you write us, we'll send you the whole story in a helpful booklet, and the name of our nearest Member. Call him, he will gladly suggest the best answer to your property protection problem.

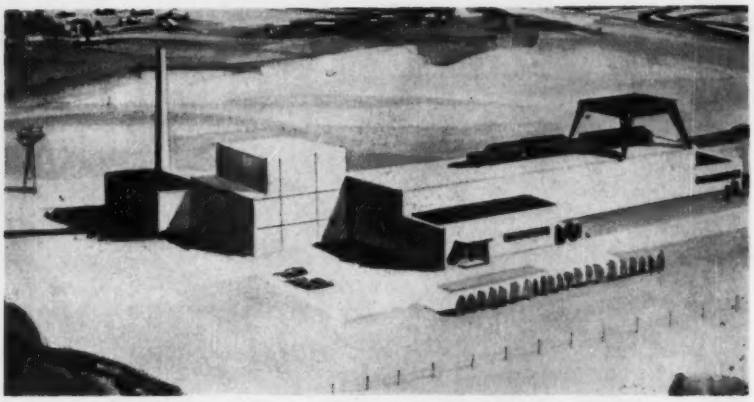
Helpful booklet describes fence styles, gates and, components



PAGE FENCE ASSOCIATION
National Headquarters • Monessen, Pa.
A product of Page Steel & Wire Division American Chain & Cable Co., Inc.

ties. Plans call for doubling the present area when required. All branches of the company's research, development and manufacturing departments needed to be expanded because of unprecedented domestic and foreign demand for products.

• **Pyramid Instrument Corp** changed its name on August 1 to Amprobe Instrument Corp. Most distributors and customers reportedly have always referred to the company by the new name, because of the thousands of clamp-on volt-ammeters and cable tracers it makes under the trade name of Amprobe—along with other portable electrical testers.



ATOMIC POWER STATION resembles compact conventional power plant. Standard designs are being offered in ratings of 100, 200, 300, 400, and 500 Mw

GE Offers Line of Atomic Plants to 500 Mw

General Electric Co has announced it is now offering a full line of atomic power plants rated up to 500 Mw which are expected to produce electricity at a cost equal to conventional power stations in the higher fuel cost areas of the country—probably between $165 and $200 per kw.

The new plants, featuring advanced boiling-water reactor system and carrying nominal ratings of 100, 200, 300, 400, and 500 Mw, are being offered to US utilities at firm prices and with guaranteed net plant electrical output.

Reported George White, general manager of GE's atomic power equipment department, "The designs of the five new plants are based on testing and operating data from the Dresden Nuclear Power Station near Chicago, and other results from continuing technical development programs with electric utilities and Atomic Energy Commission." He added that the reliability of the nuclear plants is expected to be as high as conventional steam stations.

The Dresden Station, this country's largest operating nuclear power plant, was designed, built and placed in operation last year by GE for Commonwealth Edison Co.

Among the many features of the new plants resulting from technical development programs, are nuclear cores of high-power density, steam separation within the reactor vessel, and the pressure suppression containment.

The 400 and 500-Mw plants are believed to be the largest nuclear power stations ever offered to the utility industry, only exceeded by a few fossil-fueled power stations.

With the exception of the 500-Mw station, the new plant design eliminates the need for the traditional containment sphere or capsule, thus giving the plants the outward appearance of a conventional power station.

introducing . . .

PENNSYLVANIA'S new POWER SUPPLY CENTER

for shopping centers, industrial plants, schools

- eliminates fences, overhead structures in installations through 2500 kva, 15 kv
- designed for low initial cost, long-range economy

dimensions . .
weights . . . . .
prices . . . . . .

a development of
PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY • CANONSBURG, PA.

For utmost safety, door to high-voltage compartment (left) cannot be unbolted without first unlocking and opening door to low-voltage section. Note protective shield in front of high-voltage terminals.

Space-saving standardized unit reduces costs in installations through 2500 kva

Pennsylvania's new three-phase Power Supply Center is specifically designed for use with underground primary feeders, in applications ranging from 750 through 2500 kva, 15 kv and below. At shopping centers and other commercial areas, small industrial plants and schools, it permits the elimination of unsightly fences and overhead structures without the expense of underground vaults. Appearance can be further enhanced by the addition of shrubs and trees, or by other landscaping.

All live parts enclosed

The Power Supply Center requires less space, too . . . may be installed immediately adjacent to buildings. It is available in either standard transformer gray or forest green.

Live parts are completely enclosed in weatherproof,

New Pennsylvania POWER SUPPLY CENTER eliminates fences and overhead structures at shopping centers, industrial plants, schools

1000-kva Pennsylvania Power Supply Center. H.V.: 13,200△ volts. L.V.: 480Y/277 volts.

tamperproof compartments with padlocking facilities. To protect utility personnel, standard load-center accessories are located inside the low-voltage compartment.

Low initial cost . . . long-range economy

The standard Power Supply Center is built to accommodate primary cable from underground, with either top or bottom cable entrance on the secondary. Optional accessories are also available at additional cost —including provisions for bus duct entrance on the secondary, potheads, lightning arresters, fuses, and provision for the utility's metering equipment. A complete listing of accessories is on the back of this page.

Initial cost of Power Supply Centers reflects a concentrated effort on the part of Pennsylvania Transformer's engineers and production specialists to provide high-quality standardized units at the lowest cost consistent with realistic business considerations.

For your convenience in ordering or computing costs, prices of standard Power Supply Centers are on the back of this page. Complete information regarding the cost of optional items also is included.

Long-range economies result from the elimination of normal maintenance costs for fences and overhead structures. Also, there is less likelihood of damage from the elements . . . and less chance of service interruptions.

More details and complete pricing information on reverse side

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS

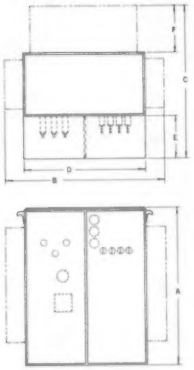
PENNSYLVANIA TRANSFORMERS

FACTS and FIGURES on Pennsylvania's Power Supply Center for shopping centers, industrial plants, schools

Designed for low initial cost . . . long-range economy
Prices for the *standard* Power Supply Center should be particularly attractive to users because of the manufacturing economies standardization makes possible. Optional features and accessories are available at additional cost to meet special requirements.

STANDARD POWER SUPPLY CENTER . . . Ratings, Dimensions, Weights, Prices

High Voltage* (Delta only)		Low Voltage	KVA	DIMENSIONS—In Inches						Total Weight Pounds	NET PRICE†	
Volts	BIL (kv)			A	B	C	D	E	F		Eastern Zone	Western Zone
2400	45	480/277	750	89½	80	70 5/16	58⅜	20	18 11/16	10,800	$5,665	$5,835
4160	60	480△	1000	94½	92	74 5/16	62⅜	20	22 11/16	12,800	6,605	6,803
4800	60	600△	1500	100½	100	79 5/16	62⅜	20	26 11/16	16,200	8,800	9,064
6900	75		2000	110½	105	85 5/16	67⅜	20	30 11/16	19,700	10,710	11,031
7200	75		2500	125½	116	90 5/16	70⅜	20	34 11/16	24,800	12,157	12,521
12000	95											
13200	95	208Y/120	750	89½	80	70 5/16	58⅜	20	18 11/16	10,800	6,030	6,210
13800	95		1000	100½	92	74 5/16	62⅜	20	22 11/16	13,800	7,050	7,262



*Standard taps—2 above and 2 below

†Freight allowed to railroad siding nearest destination.

STANDARD FEATURES AND ACCESSORIES

Prices quoted above include isolated high- and low-voltage terminal compartments, with hinged doors . . . provisions for cable entrance . . . and load center transformer (55C rise, standard impedance, oil-immersed) with the following accessories:

- 3 high-voltage bushings (15 kv)
- 4 low-voltage bushings (1.2 kv)
- Permanently welded radiators
- Welded-on cover
- Tap changer for de-energized operation (with provision for padlocking)
- Lift lugs
- Liquid-level gauge
- Dial-type thermometer
- Pressure-vacuum gauge
- Welded-on handhole cover
- Filter press connection
- Drain and bottom filter valve with side sampling device
- Formed base with provision for jacking, skidding, rolling
- Connection diagram nameplate
- Stainless-steel ground pad

OPTIONAL FEATURES AND ACCESSORIES

The following items are available at additional cost, as stated:

High Voltage:

Fuses (3 SM4, with S&C Loadbuster feature).....$600
Potheads (1 3-conductor or 3 1-conductor).....$320
Lightning arresters (set of 3).....3 kv, $70; 6 kv, $100; 9 kv, $135; 12 kv, $165; 15 kv, $225
Provisions only for lightning arresters.....3 or 6 kv, $25; 9, 12 or 15 kv, $40

Low Voltage:

Provision for bus duct connection.....1600 amps., $405; 2000 amps., $635; 3000 amps., $1060; 4000 amps., $1425
Provision for mounting utility's metering transformers, $150

Open compartment doors permit view of one utility's method of connecting the Power Supply Center. The unit is 750 kva, 13,800△—216Y/125 volts.

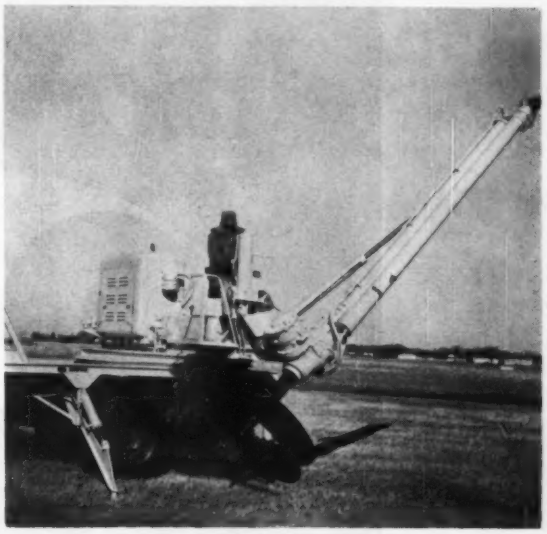
Address orders and inquiries to: Switchgear Sales

PENNSYLVANIA TRANSFORMER DIVISION

McGraw-Edison Company **Canonsburg, Pennsylvania**

<<<*Turn to preceding page for complete picture of Power Supply Center's advantages*

Earth-Boring Digger . . .

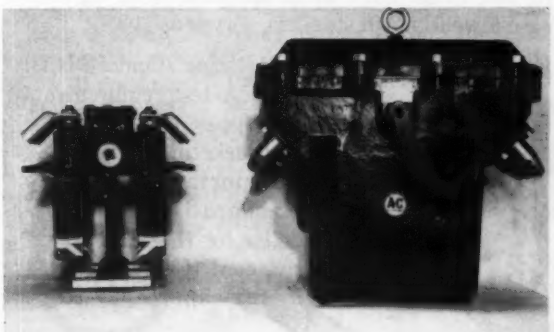


. . . **penetrates all types of soil** at 30-ft maximum depth, swinging augers from 9 to 96 in. The HFMS skid-mounted, heavy-duty digger, which can be mounted on either the Spotter Base or the Swing Base, has a self-contained, 4½-in.-sq Kelly bar to provide speeds in feed and retraction at up to 20,000-lb down pressure. The bar, encasing the hydraulic feed ram at the auger end, is rotated by a solidly-enclosed gear collar and the only hydraulic seal required is on the top actuating ram. These design features completely protect against outside contamination. Hydraulic "all-way leveling" allows 45-deg lateral for anchor holes and 25 deg under the vehicle. The hydraulically-actuated clutch transmits up to 200 hp, while allowing the operator to "feel" the clutch action as he does with manual controls. A 42-ft sheave is attained by a 3-stage hydraulic telescoping derrick with 7,500-lb capacity.
Highway Trailer Industries, Inc, Stoughton, Wis.

Telemetering Equipment . . .

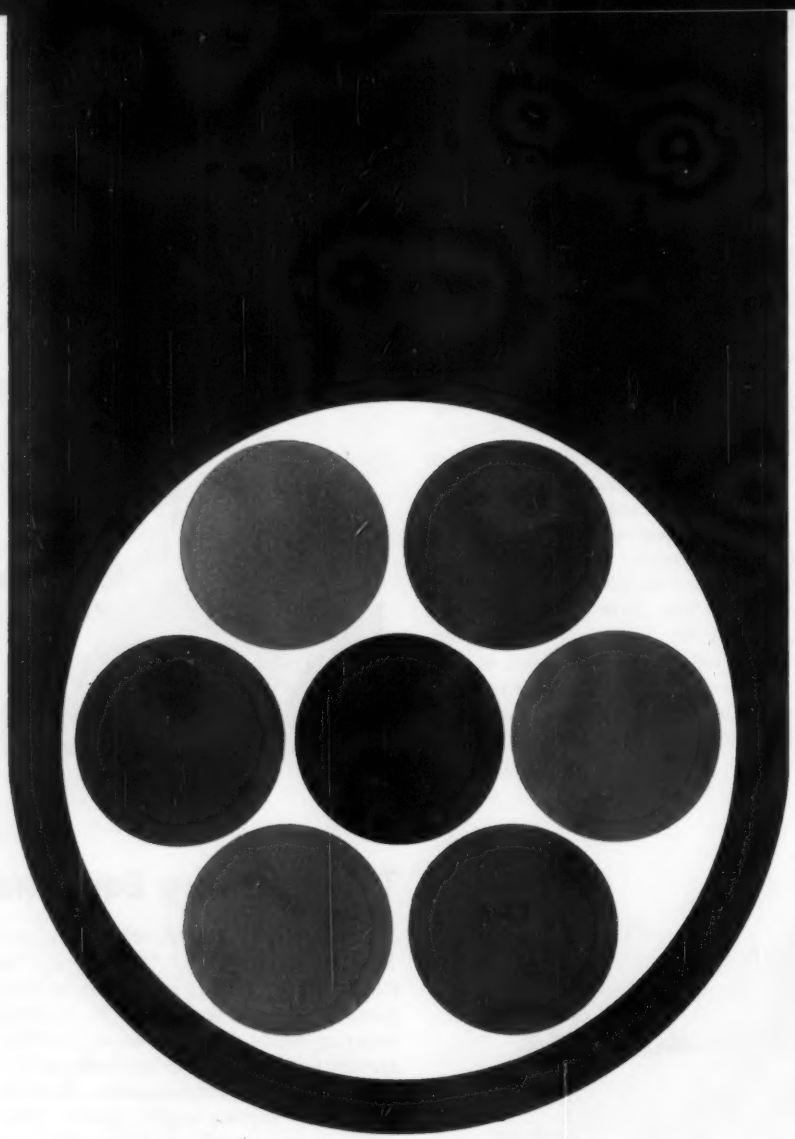
. . . **completely transistorized,** frequency-type, called Tele-Dac, consists of a 15 to 35 cps transmitter and a receiver. Any quantity that can be converted to a proportional dc mv signal can be transmitted. For telemetering where speed, accuracy, stability and reliability are required, the self-monitoring unit is said to be suitable, also, for communication channels susceptible to noise and varying signal levels. The design and a stable negative feedback loop in the transmitter provide over-all accuracy of ±1%, excluding end devices. Units may be mounted with channelizing equipment on standard 19-in. telephone racks or cabinets.
Westinghouse Electric Corp, Pittsburgh 30, Pa.

Subway-Type Oil Switch . . .



. . . **5 kv, 300 amp,** withstands momentary and short-time currents to 25,000 amp. M-35, a three-pole unit, has procelain insulators, laminated copper brushes and stud and contact blocks. Although non-automatic, the watertight switch is designed for disconnect service on underground distribution systems where positive and safe operation is necessary without frequent adjustment and inspection, e.g., switching transformers and sectionalizing of lines.
Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.

(*More New Equipment on page* 66)

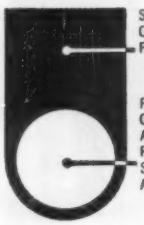


NEW WAY TO EVALUATE CABLE!

"VALUE RATINGS" RELATE PERFORMANCE TO IPCEA OR COMPETITIVE STANDARDS

New Value Ratings tell at a glance the composite story of each Kaiser Wire construction—as it performed in as many as 25 specified tests. In each case a well-known standard serves as 100%:

For power cable, the Value Rating standard is all IPCEA test requirements for types of insulation and jacketing specified . . . For portable cord, the standard is service-per-dollar for the least expensive cord (C.V.) as proved by life-expectancy tests.

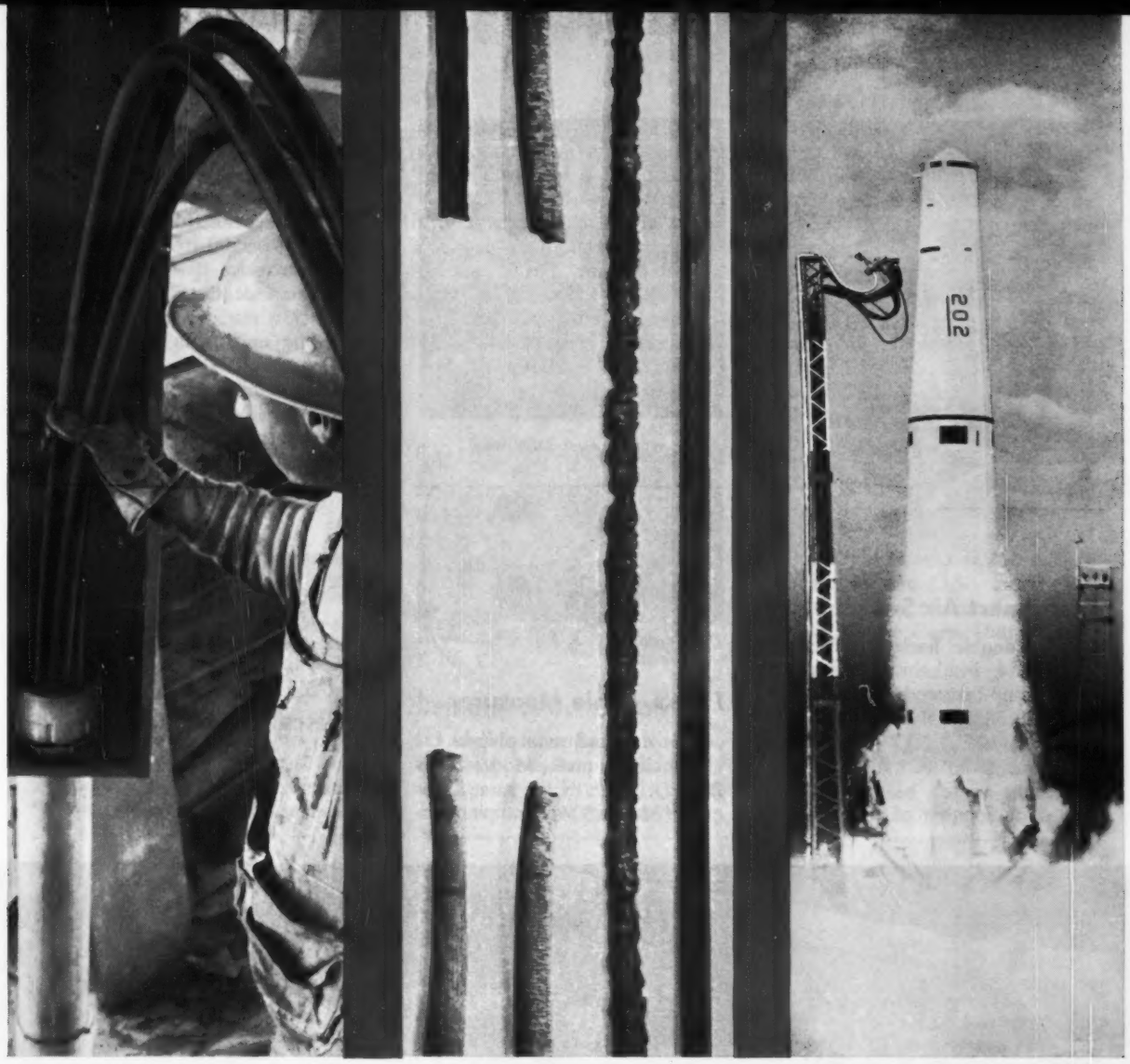


. . . For control cable, the standard is a composite of minimum requirements for eight important insulation qualities.

Compared to these standards, Kaiser Wire constructions earn Value Ratings as large as 767%—valid proof that the spark of quality is Kaiser Wire experience.

For details and Value Rating listings, ask your Kaiser Wire Distributor for free K/W Value Rating Bulletins, or write: Kaiser Wire, Room 844a, Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM & CHEMICAL CORPORATION



KAISER GRIZZLY® POWER CABLES PACK RUGGED "DOUBLE PROTECTION"

The insulation and jacketing of K/W Grizzly Spec. 831 power cables deliver more than double the protection required by IPCEA specifications. In ozone resistance, K/W Kalzone® insulation (special butyl compound used in K/W Grizzly cables) exceeds the IPCEA 3-hour minimum by *more than 70 hours*. Typical test values after aging of special K/W Neoprene 10-S jacketing exceed IPCEA minimums by wide margins. Overall comparison against IPCEA tests: 270%—the Value Rating of K/W Cable Spec. 831.

K/W GRIZZLY POWER CABLE SPEC. 831 VALUE 270% RATING

KAISER NEOPRENE 10-S CABLE JACKET RESISTS OZONE LONGEST

The picture above shows competing neoprene jackets that were stretched to twice their original lengths and exposed to .025-.030% ozone. Time: 2 hrs., 23 min. from start. Two have failed. Seven minutes later, the third competitive sample (second from right) failed. The jacket at right—special Neoprene 10-S used on K/W Grizzly power cables—was intact *18 hours later!* Kalzone® insulation of K/W Grizzly cables stood 72 hrs. in similar tests. IPCEA butyl insulation requirement is 3 hours.

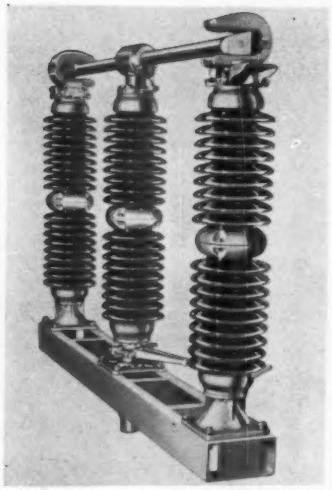
K/W GRIZZLY POWER CABLE SPEC. 831 VALUE 270% RATING

KAISER LAYTEX® CONTROL CABLE SENDS "THOR" TOWARD ITS TARGET

A single K/W Laytex control cable of 84 conductors gives Air Force "Thor" its final sendoff. Kaiser Wire has designed more than 650 such cables for missile ground controls, offering distinct advantages: Patented K/W Laytex gives greater insulation protection than any other rubber, and resists heat better than plastics. The patented Laytex-Resin construction delivers final cable diameters that are among the world's smallest. The choice of K/W insulations is the industry's widest.

K/W LAYTEX-RESIN CONTROL CABLE VALUE 767% RATING

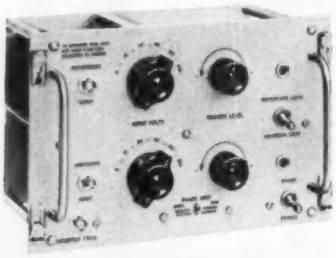
IN COPPER AND ALUMINUM CABLES...THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE! KAISER ALUMINUM



Disconnect Air Switch . . .

. . . has double, horizontal break with three insulator stacks per pole, group-operated; is available in 115, 138 and 161-kv units—in 600, 1,200, 1,600 and 2,000 amp. Motion of the blade, parallel to the switch base, is controlled by rotation of the center insulator stack—with the blade pivoting at its mid-section over the center stack and blade weight balanced within itself. Contact fingers are arranged in a reverse loop configuration to increase contact pressure during momentary surges. Housing is fully sealed against the weather.

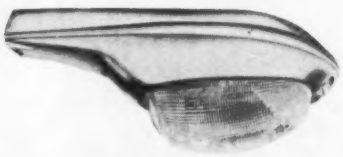
James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.



Phase-Angle Measurer . .

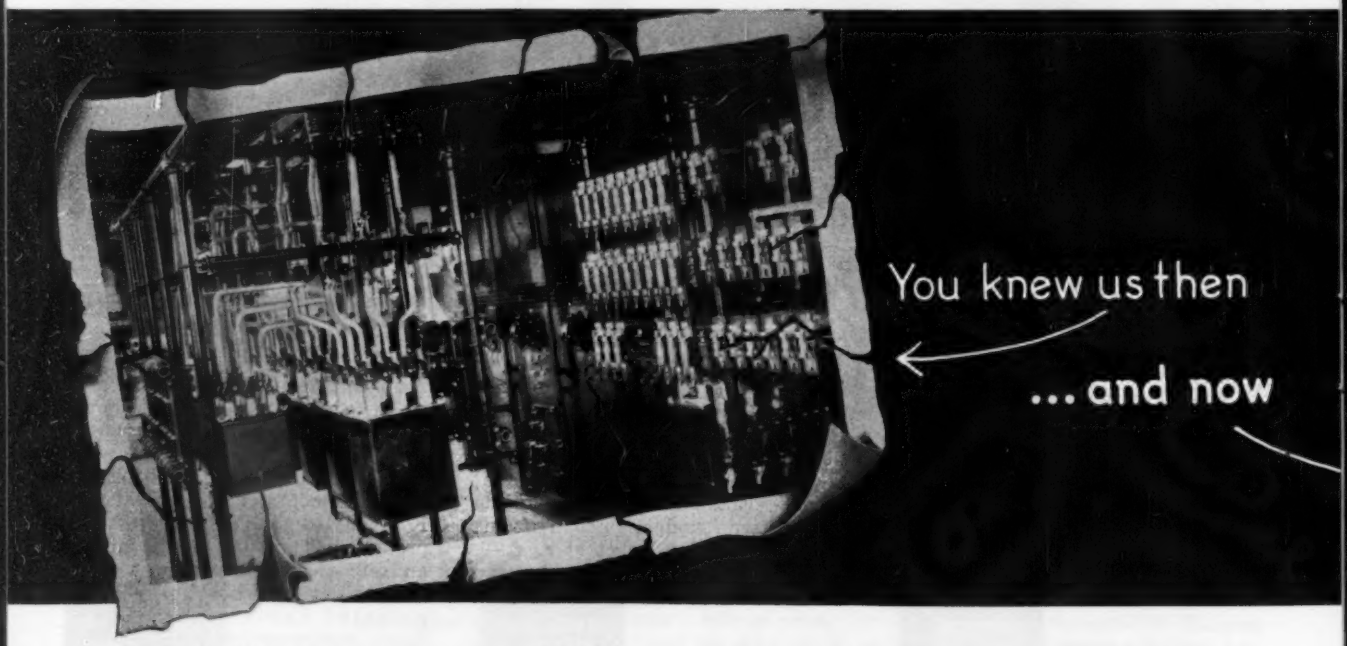
. . . is designed as a plug-in for electronic counters, Models 524-B/C/D, made by the same company. Model 526D equips counter to measure any lead or lag phase angle between two signals in the 1-cps to 20-kc range. Accuracy approaches ±0.1 deg. For frequencies from 396 to 404 cps, an X 3600 frequency multiplier provides reading direct in tenths of degrees; at other frequencies, readings are presented in time units with a resolution of 1 μsec for full frequency range. The unit offers either ac or direct coupling and has an imput impedance of 1 megohm.

Hewlett-Packard Co, 1501 Page Mill Rd, Palo Alto, Calif.



Mercury Luminaire . . .

. . . is offered with built-in, constant ballast or high-power-factor reactor ballasts. It is also avail-



Allis-Chalmers sets the pace for switchgear progress

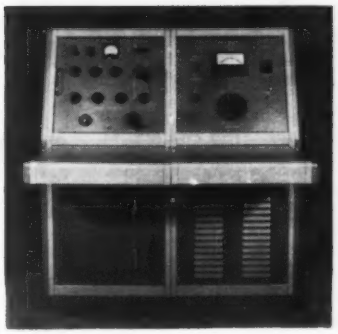
Nakedly exposed — yesterday's indoor switchgear is totally unlike modern, compact A-C metal-clad enclosed units.

But even then, A-C engineers wouldn't accept status quo. These design pioneers began turning out a long series of industry power equipment firsts. A few of these are: Front-access current transformers • Track-resistant insulations • New relays with *no* moving parts • Steam turbine-generating units with space-saving centerline-at-floorlevel design • Also distribution oil circuit breakers with transmission breaker-type tank-per-phase protection.

able with a mounting adapter for EEI-NEMA standard plug-in locking-type photoelectric control. The 2600 Series Unitized Endoval uses 250 or 400-w mercury lamps to provide high-level, glare-free lighting. Adjustable socket positions produce ASA-IES Type II, III, or IV with proper choice of lamp. The unit is designed to fit either 1¼ or 2-in. pipe-mounting arm.
Revere Electric Manufacturing Co, 7420 Lehigh Ave, Chicago 48, Ill.

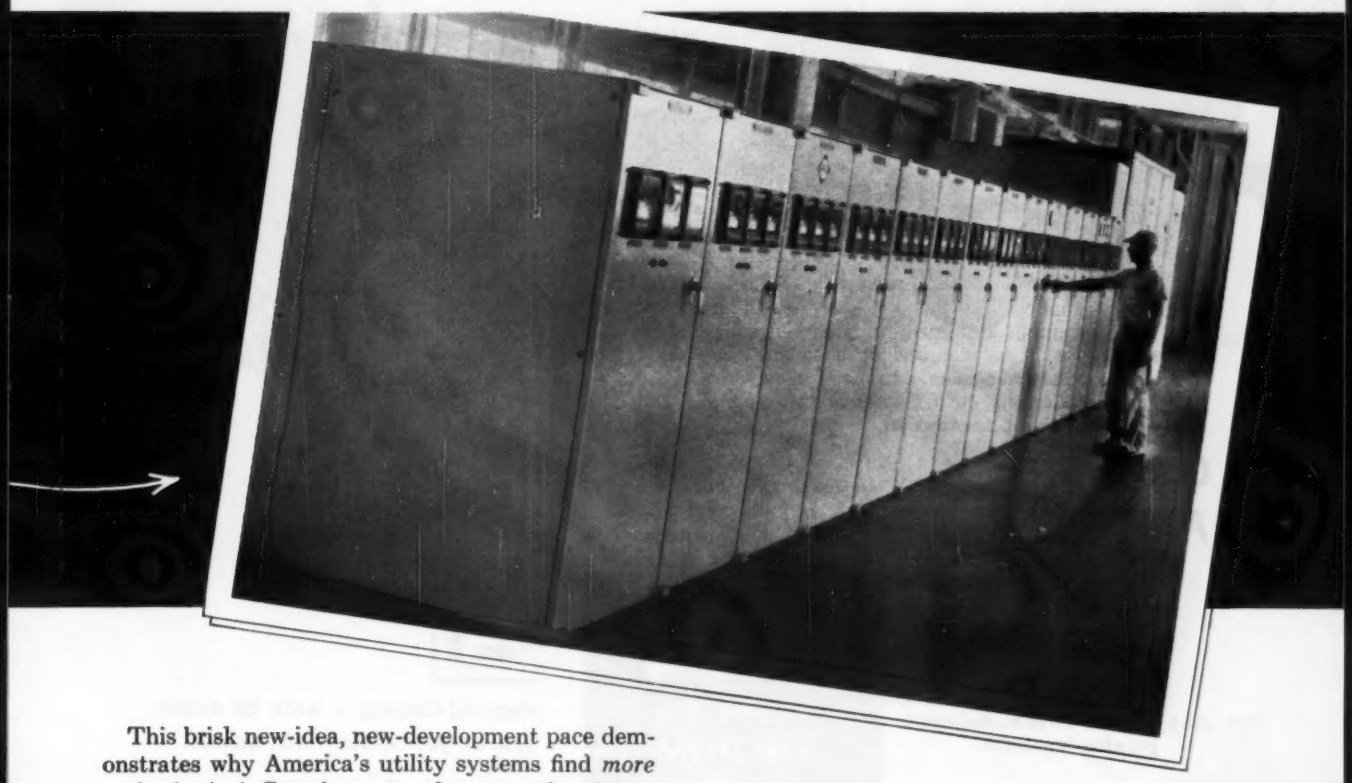
H-V Capacitance Bridges

. . . feature direct reading and built-in performance check of capacitance, dielectric losses and dissipation factor of insulation and insulated apparatus—e. g., bushings, power cable, transformers, generators, motors and switchgear. These characteristics may be measured while insulation is stressed at operating voltage. The 40-kv units are available in mobile or stationary consoles at up to 500 kv or any higher voltage which may be desired. They feature an accuracy of capacitance measurement of 0.2% and dissipation factor measurement of 0.01%.
General Electric Co, Schenectady 5, N. Y.



Remote Alarm Monitor

. . . solid-state, samples and encodes any number of data points and keys a single channel of any transmission medium. The Alertra Model 901 operates continuously, and microwave, UHF, VHF, or any grade telephone line may be used with it. Circuitry is completely transistorized; construction is plug-in type and compact. Seventeen points are contained in a 3½ X 5 $\frac{3}{16}$ X 6 $\frac{3}{16}$-in. package; by adding packages, any number of points can be monitored. Switch closures or excessive voltage levels, detected at the transmitter, are keyed over the transmission medium in coded form. At the receiver, the code is converted to "yes"/"no" information and displayed as alarm conditions on a panel board. Rack or desk mounting is available, and 115-v ac or 12-v dc operation are standard.
CompuDyne Corp, Hatboro, Pa.



This brisk new-idea, new-development pace demonstrates why America's utility systems find *more real value* in A-C equipment . . . for generating, transmitting and distributing *low-cost* power. *For more information, write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin*

ALLIS-CHALMERS

A-1459

Here are answers to some about KPF switches

Q. *How can KPF switch blades maintain positive contact with switch clip under changing line sag conditions?*

A. Two heavy copper clips, bolted to a shoe carrying the flexible jumper, are mounted inside a special "horseshoe shaped" casting by two toggle bolts. These toggle bolts pass freely through the outer leaves of the clips, and the entire contact assembly "floats" on these bolts. Half-spherical bolt heads and adjusting nuts permit movement in any direction. The tension of the clip leaves on the blade is sufficient to insure positive alignment, since either clip or blade can follow the other to conform to line sag changes.

Q. *How can insulator stacks follow normal line sag changes?*

A. The insulator stack bearing units may be likened to limited universal joints. The actual bearing, a monel pin in an everdur trunnion, allows 90° movement of the rotating arm of the phase unit, as well as approximately 7° vertical movement to follow line sag. It is impossible for the bearing to bind under normal line stress, and insulator stacks always follow the sag of the conductor.

Q. *How are conductors connected to KPF switches?*

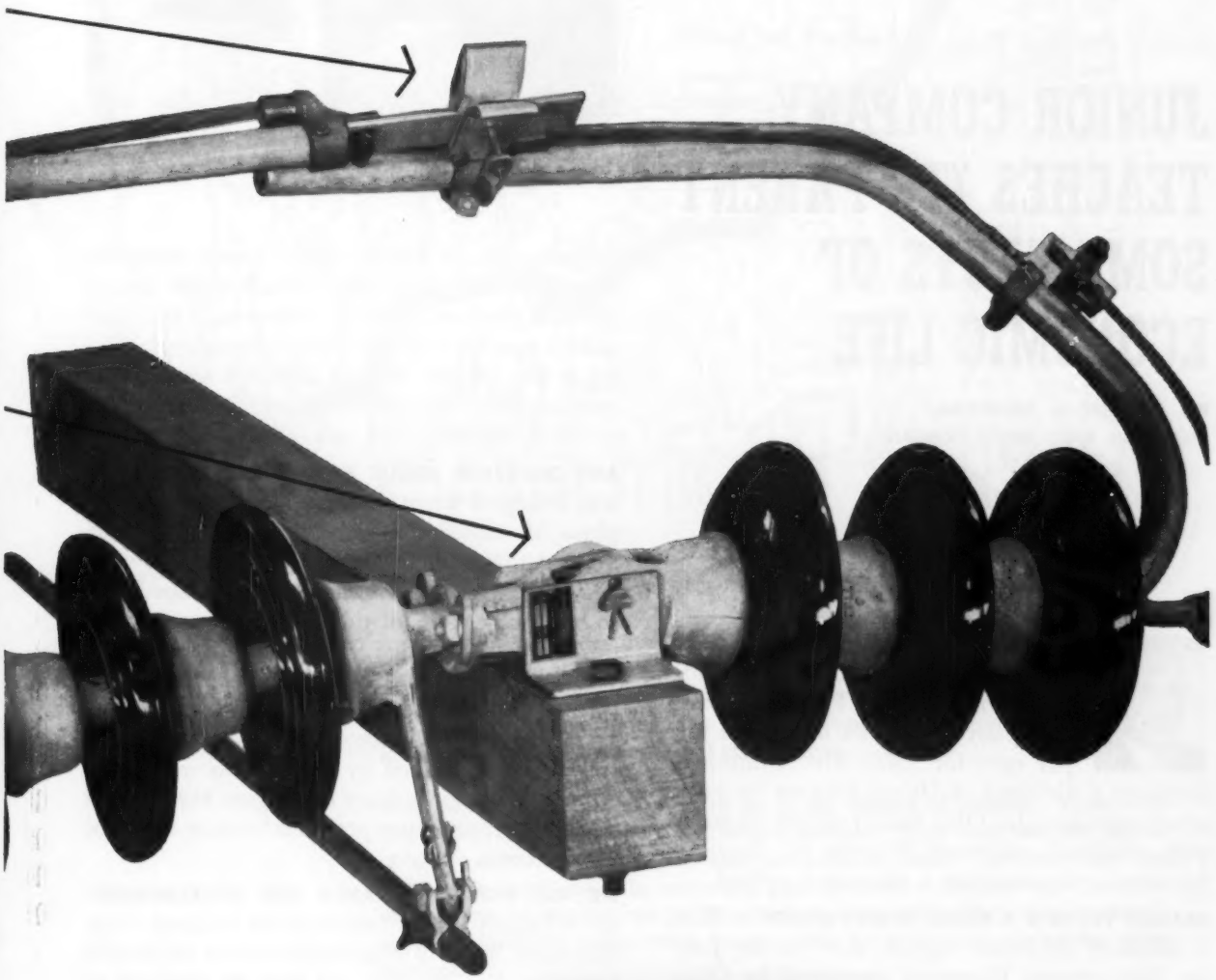
A. With KPF Type A switches, the user eliminates dead-end insulators. Any standard strain clamp can be used, and hot lines may be dead-ended directly to the phase units. Switch arms and dead-end eyes are integral with the insulator assembly. The conductor is lead through the strain clamp and on to a copper terminal on the switch arm. Aluminum conductors may be connected to the switch arm through special KPF terminals designed for this service. Type A switches may be mounted on a separate crossarm with conductors deadened below or above (for angle-pole installations, etc.). Switch operates equally well with or without line tension.

Q. *For what voltages are KPF air break switches available?*

A. KPF Type A and S standard "line-tension" switches are available for common voltages from 7.5 to 110 KV. Special switches combining a disconnect with a fuseholder (Type UF, double-cross-arm mounting) and for use where line tension is not present are also offered in these same voltage ranges. Ground switches are available for Type A or S switches. Type R switches are offered for use where line tension is not present or it is desired to use a specific type of apparatus insulator.

Request Catalog or write for details.
Test on your system this month!

often-asked questions



KPF

AIR BREAK SWITCHES

Standard for half a century

KPF ELECTRIC CO.
P.O. Box 1257E
Stockton, California
HOward 4-8381 • Area Code 209

5218

OHIO BRASS MANAGEMENT REPORT

JUNIOR COMPANY TEACHES ITS PARENT SOME FACTS OF ECONOMIC LIFE

BY GEORGE L. DRAFFAN
CHAIRMAN, OHIO BRASS COMPANY

Fire Unlimited had a net income of 8.3 per cent of sales for the year ending April 30, 1961. The Ohio Brass Company had a net income of 4.5 per cent for 1960. Fire Unlimited declared a dividend of 10 per cent on its stock after seven months. Ohio Brass reduced its quarterly dividend rate from 50 cents per share to 40 cents — 80 cents for a six-month period.

BEFORE THERE'S A RUSH TO BUY STOCK in Fire Unlimited, I'd better explain that it's the Junior Achievement Company sponsored by Ohio Brass in our home town of Mansfield, Ohio. Incidentally, it finished second among 18 local companies in competition for Company of the Year, and took first place in the Industrial Award Competition among 1200 Junior Achievement companies. Since the principal objective of Junior Achievement is to give high school students a "learning by doing" course in business economics, it would appear that Fire Unlimited has learned its lesson better than O-B.

HOWEVER, IN ANALYZING THE EXPENSES of the two companies I see no charges for research and development in the statement of Fire Unlimited. O-B could come near the profit per-

formance of its Junior Achievement company by eliminating or severely curtailing the cost of product research and development. Let's consider a specific example. The suspension insulator is the biggest volume item we make. Last year we spent ten cents an insulator for specific research on extra-high voltage transmission.

ANY QUESTION ABOUT SAVING THE TEN CENTS was removed when industry leaders announced plans for building a 775-kv test line. A whole new set of problems was presented at this voltage level. We had the facilities and experience to help solve some of them. There was no hesitation. We cooperated. As a result, in five or ten years, when your utility or a neighboring utility throws the switch energizing a 775-kv transmission line, there will be definite assurance that components supplied by Ohio Brass will work. And even if your voltage never goes higher than 33 kv, you'll get better products because we spent the ten cents.

WE ALL AGREE RESEARCH AND DEVELOPMENT are necessary for the future of our industry. Traditionally, much of it has been done by the manufacturers. For our part, we hope to continue to do it. We also hope that prices will support even more R & D on the products we supply. You can see we're optimistic. We're still planning to catch up with Fire Unlimited.

10151-H

OHIO BRASS COMPANY, MANSFIELD, OHIO
Porcelain Insulators – Line Hardware – Capacitors – Lightning Arresters Bushings – Holan Truck-Mounted Power Devices and Bodies – Bronze Valves

Electrical World

AUGUST 21, 1961

Management Newsletter

Pricing the Growth Utilities – Part II

Are the growth utilities over-priced? Wall Street security analysts don't agree on the answer to the question. One group of analysts feels that current prices are counting on earnings in the future which are far from certain. They'd like to see the price come down. But another group feels that even at today's high levels, growth utility shares are still under-priced.

Basis of the disagreement seems to be in the method of analysis. Those who feel utilities are over-priced use a vertical analysis. They study the past record of utility commons to find a normal price-earnings ratio. Then they use this norm as a bench mark in evaluating current prices. Analysts who feel that utility shares are under-priced put less stress on past history. They use a horizontal approach, weighing utility prices against prices for industrials offering the same earnings.

Last week, in the first part of this series, *Management Newsletter* outlined the steps used in vertical analysis. In this approach, analysts review the past performance of utility shares. Such a review leads to the conclusion that a price-earnings multiplier of 18 may well be a normal future multiplier for a utility with a 5% annual growth in earnings per share. After determining a normal multiplier, analysts of this school establish a correlation between growth rates and years in the future for which the growth rate is expected to endure. Such a correlation establishes "justified" price-earnings ratios which the analyst then uses as bench marks against which to measure prices.

If you use this method of approach, you reach the conclusion that current utility prices are far too high. In many cases they are based on a continuation of current high earnings for the next 10, 15, or even 20 years. But it's hard to say what earnings will be that far in the future. Analysts using the verticle approach feel that utility prices should come down so as to reflect only those earnings which are reasonably predictable.

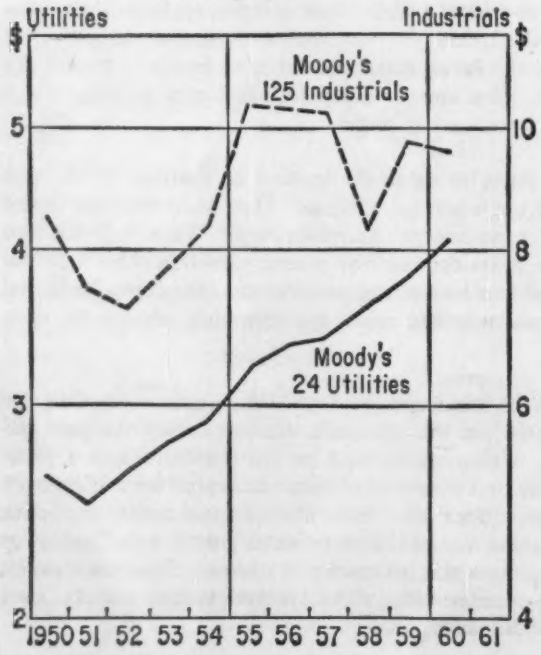
But a strong case is presented by those who feel utilities are still under-priced. These analysts agree with the mathematics performed by the vertical school. But they feel that such computations are over-stressed. Similarly, they feel that a "normal" price-earnings ratio is something of a misnomer. And even if it did exist, it would, in all probability, be quite irrelevant.

"Sound investing," these analysts argue, "requires a study of the entire securities market." The important question is not, "Are utilities over-priced when compared with their own past performance or probable earnings?" The decisive point is, "Are they over-priced when compared with other securities of similar quality which promise approximately the same growth in earnings?" They are not overly concerned with the history of utility commons. But they are very concerned with what the investor gets for his money when he buys utilities as opposed to buying shares of an industrial.

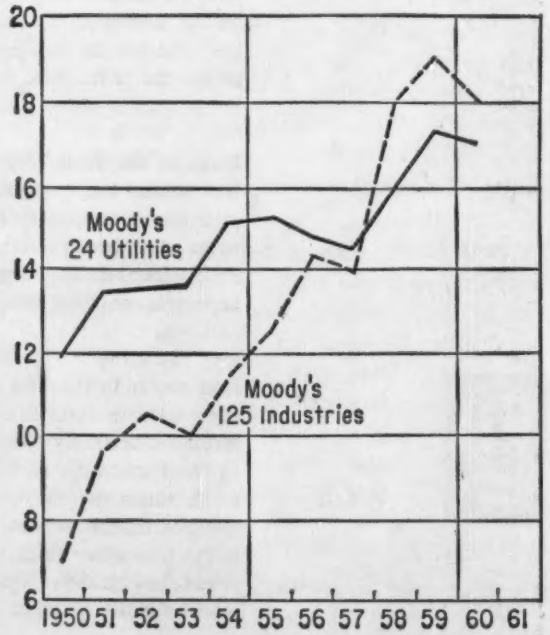
The difference between the two methods of evaluating a stock is clearly defined. The vertical analysis is seeking a "correct price" for the share. But the second group of analysts are using a horizontal approach. They are not so much seeking a "correct" price as they are a "best" price among all possible investments. They look at the market not in the past, but rather in the present. And they attempt to find the "best" investment available now, even if that investment is over-priced today compared with its past performance.

The first question that must be settled by the horizontal school is, "Are the utilities over-priced when compared with industrials?" Here we can turn to a booklet prepared by Tri-Continental Corp which is based on an address by Frederick W. Page, Tri-Continental vice president. The booklet contains these two tables.

Earnings per Share



Price-Earnings Ratios



The charts show clearly that price-earnings multipliers for industrials have climbed to higher levels than similar multipliers for utilities. They also make it clear that the rise in utility multipliers has been based on a steady rise of utility earnings. The industrial multiplier, on the other hand, has risen in spite of declining earnings for industrial shares.

Growth-industry multipliers are far higher than those for comparable utilities. Minneapolis-Honeywell, for example, is over 40 to 1. IBM is better than 60 to 1. Yet, as Page points out, utility stocks "showing the fastest earnings growth rate, comparable to that of Minneapolis-Honeywell or IBM, are selling at 24 to 30 times earnings." An investor is buying the same growth for less money when he buys a utility share. This means that utilities are cheap when compared with industrials, and would still be the better buy even if their price-earnings multipliers were somewhat larger.

Of course, it might be argued against the horizontal school that this comparison doesn't prove that utilities are under-priced. It merely shows that industrials are even more flagrantly over-priced than are the utilities. Certainly, utility prices shouldn't be justified by mistakes in other areas.

But analysts of the horizontal school insist that this is missing the point. If a person has money to invest, there are many ways he can go about it. He can put his money in the bank, invest it in real estate, or even decorate his home with works of art, hoping that the items will some day command a higher price. But many individuals and many institutions feel that common stock is the best outlet for investment. Common stock provides protection against inflation. It gives the investor an opportunity to participate fully in the success of a growing company. Furthermore, it is highly liquid.

Since a great many investors want common stock, the only important question is which commons are the best investment. Whether or not commons are high by some standard of "normal" performance is much less significant. The significant point, horizontal analysts insist, is that utilities are greatly under-priced relative to other commons. Therefore, they're the best buy. And even if their price-earnings multipliers moved up several points, they would still be cheap relative to industrial commons and would still be the best buy.

The second question which horizontal analysis faces is, "Are utility commons and industrial commons comparable?" It's frequently argued that utilities and industrials are two different animals. Perhaps industrials deserve higher price-earnings ratios, and, if they do, then the horizontal case falls.

Regulation is the most obvious difference between the two kinds of enterprise. Utilities have their profit levels set by regulatory action. Their accounting methods are dictated to them. The size of their geographic territory is based not on their ability to meet the market, but rather on the decision of a public body. They don't have the freedom of an industrial corporation to develop new products, market them effectively, and thereby turn a new idea into high profits. Should they, for these reasons, be expected to carry lower price-earnings multipliers?

Analysts using the horizontal approach say, "no." The point of comparison is earnings, and the number of years during which those earnings may reasonably be expected to endure. On this point, the industrials have little advantage over the utilities. Certainly, a regulatory agency may cut the utility's rate of return. But a shift in customer preference for an industrial product can cut the manufacturer's return much more drastically. True also, the utility's territory is limited. But the industrialist may lose sales to a competitor right outside his plant. The utility is the sole seller of the product within its territory. Granted, freedom to raise prices protects the industrialist against inflation, but fuel cost and labor cost clauses give the utility a measure of the same protection between rate reviews.

It is true that the industrial share may benefit from the unique prosperity of the company's product, and may for a short period of time show returns far above what a commission would allow to a utility. But balancing this out, the same industrial that booms when its product catches on may show continuous losses when public taste moves on to another product. The utility is relatively immune from such fluctuations.

After weighing the evidence, analysts of the horizontal school find that the utilities and the industrials are not in two different worlds. In both cases, the investor is hoping for a return on his money. In neither case can he be sure just what that return will be, nor can he know just how long it will continue. With this in mind, these analysts see no reason for the current discrepancy between industrial price-earnings multipliers, and utility price-earnings multipliers.

Pulling their two basic points together, the horizontal analysts feel that utilities and industrials are quite comparable. And, when they are compared, the investor finds that utilities offer the same amount of growth as industrials, but for a far lower price. Whether this price is "justified" by the utility record over the past five or ten years is immaterial. To the investor, a justified price isn't very important. What he wants is the best buy in today's market. This, they argue, is clearly the utility common.

Analysts following this line of reasoning see nothing exceptional in the performance of utility commons during the 50's, and more particularly during the past three years. They recognize, of course, that the utilities have out-performed the industrials, but they feel that this performance has been based on the utilities record. Investors have recognized the growth potential of utilities, they say, and are now beginning to price them according to their worth rather than according to some outmoded philosophy that they should be priced as defensive securities which lack the opportunity for appreciation in earnings.

For the future, they expect utilities to continue to out-perform industrials, at least until the prices of the two types of offerings are brought more into line. They dispute the vertical school which argues that utility shares will lose momentum until "justified" value catches up with price. Instead, they feel utility commons will keep right on rolling until their price-earnings multipliers catch up with those of industrials.

Each side in this debate finds flaws in the other's argument. Vertical analysts, for example, ask the horizontal advocates to carry their argument to its logical extreme. If industrial price-earnings ratios suddenly doubled, should utility price-earnings ratios double also? This is, of course, a purely hypothetical situation, but it does put the horizontal analysts in a dilemma. If they say "yes," they are saying that earnings-per-share is not an important factor in determining a proper price. If they answer "no," then they are saying that the relationship to industrials is a poor way of pricing the utilities. Either way, their argument loses a good deal of its punch.

But the rebuttal goes both ways. Horizontal advocates point out, for instance, that vertical analysis will never give a correct price. In a rising market, the vertical analysis will be feeding the past performance of utility shares into its computations. Hence, it will always give a "proper" multiplier below that which the market dictates. Similarly, in a falling market, vertical analysis, as a consequence of its reliance on the past, will tend to overprice the shares.

So far, the growth utilities debate is a stand-off. Numerically, the vertical school may be ahead since most of the analysts *Electrical World* spoke with felt utilities were over-priced. But as one member of the vertical group said, "There may be more of us, but that doesn't make us any smarter; the market is the only one that will tell us who's right."

SUPERIOR

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Construction

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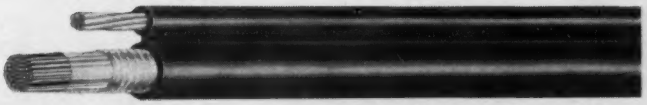
Economical Installation

There's never a need for a separate messenger because in Superior's IM construction, the jacket is extruded over both cable core *and* messenger, providing a self-supporting, full-insulated product. Can be pulled, gripped and tensioned using standard techniques. No special installation hardware is required.

Economy, efficiency and speedy installation . . . these are the outstanding advantages of plastic-insulated and sheathed SUPERIOR Integrated Messenger Cables.



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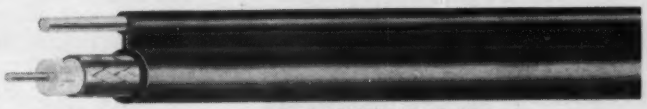
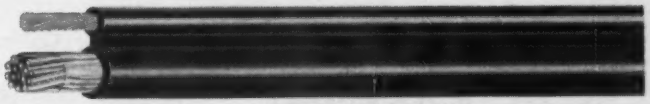
for critical control and communication circuits.



Coaxial Distribution Cable
for closed circuit TV systems.



Communications Cable
for critical signal and communications circuits.

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5579

News About People

Met Ed Elects Cox Vice President

FREDERIC COX

Frederic Cox has been elected a vice president of Metropolitan Edison Co in Pennsylvania.

Cox joined Metropolitan Edison 35 years ago as an engineer. He moved up in the company's ranks, subsequently serving in such positions as general superintendent of transmission and distribution in the central division and manager of the eastern division.

Since 1956 he has been manager of the western division (York), the position that he still holds with the company.

PERSONAL BRIEFS

Quebec Hydro-Electric Commission has appointed **Gerald Molleur** as assistant general manager in charge of personnel, and **Herbert L. McEvoy** as assistant general manager in charge of auxiliary services.

Ed F. Dissmeyer, vice president of Ohio Edison Co, has been elected a director.

Dayton Power & Light Co has appointed **Dwight L. Garber** industrial and commercial sales manager; **George W. Schwartz,** residential sales manager; and **James E. Clark,** residential sales department supervisor.

Horace H. Ferrin, vice president and treasurer of Oklahoma Gas & Electric Co, has been elected president of the Oklahoma Control of the Controllers Institute of America.

Pacific Gas & Electric Co has appointed **Robert Lee Sawyier Jr** as commercial sales director, succeeding **Stanley O. Blois** who became Colgate division commercial manager.

At Connecticut Light & Power Co, **John W. Burg** has been named Housatonic division superintendent. **Thomas F. Keena** succeeded Burg as central division superintendent.

Edward H. Adams is the new manager of Suburban Electric Co.

Carl T. Ohrn has succeeded **Fred M. Rowell** as general manager of Cape & Vineyard Electric Co. Rowell was named general manager of New Bedford Gas & Edison Light Co. **Preston H. Morris** replaced Ohrn as transmission and distribution superintendent at Cape & Vineyard.

Edward L. Bradford has been named superintendent of the meter relay department at Eastern Shore Public Service. He succeeded **James E. Willey** who resigned for personal reasons.

J. Malcolm McCardell has been elected assistant secretary and assistant treasurer of Potomac Edison Co. **Charles Morrison** was named manager of a newly formed controls department which combines metering, relaying and communications functions. **Marc A. Jansen** was appointed manager of engineering, planning and research.

At Ebasco Services Inc, **John D. Cassidy** has been named director of industrial general management consultation for the management consulting division, and **Hermann F. Bottcher** became manufacturing and operations services director for the division.

Detroit Edison Co has promoted **Donald G. Blodgett** to assistant to the superintendent of electrical system performance.

Robert E. Frazer has joined Duke Power Co as an assistant treasurer. **Kenneth Austin** is the new assistant vice president at Duke Power Co.

Philadelphia Electric Co has appointed **G. Earle Watt** as residential lighting supervisor.

Russell A. Niles has been boosted to chief distribution engineer of Wisconsin Electric Power Co. **Kenneth E. Wolters** succeeded Niles as assistant to the electrical operation manager.

Virginia Electric & Power Co has appointed **Harrison Hubard** as district superintendent, distribution department, and **Carl D. Walbeck** as assistant to the system manager, transmission and distribution department.

Iowa Public Service Co has named **Frank W. Griffith** as assistant to the president, and **Stanley M. Swanson** as gas and electric production manager.

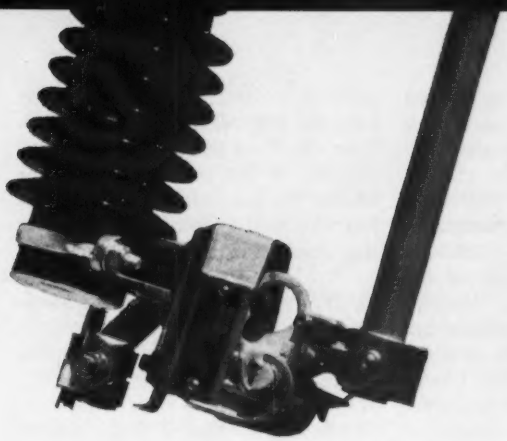
A. T. Secor has been appointed power plant superintendent at Tennessee Valley Authority's Kingston steam plant, succeeding **V. S. Pickel** who retired.

Public Service Co of Oklahoma has promoted **F. M. Whitaker** to assistant manager of electric transmission and distribution.

Jay M. Bedrick has been appointed manager of the electro-mechanical research and development department of Minneapolis-Honeywell Regulator Co's Boston division. **Robert E. Hanson** became comptroller of the division.

Bailey Meter Co has appointed the following department managers: **A. J. Hornfeck** as director for research; **J. E. McEvoy** for product

(*Continued on page* 78)



Here's how the F2 interrupts LOW FAULT CURRENTS

Most faults are down in the low and middle range . . . and here's where 100% dependability is really important. These excerpts from typical tests show how the F2 performs in the low range.

FAULT CURRENT* INTERRUPTED	VOLTAGE	POWER FACTOR
115	15 KV	10%
200	14.4 KV	50%
400	14.4 KV	40%
600	14.4 KV	30%
800	14.4 KV	24%

*Amperes RMS Asymmetrical

The FACTS are...You need more than High Interruption Capacity

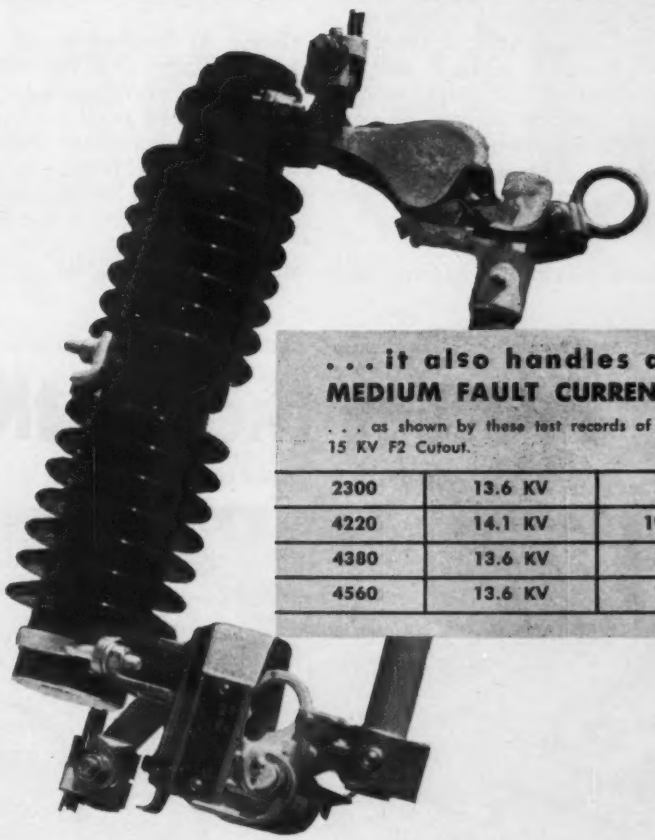
The CHANCE F2 CUTOUT Protects your system from ANY fault current...up to its maximum rating

What you really need in a cutout is overall protection . . . not just high interruption capacity, but positive performance at *all* fault currents, be they low, high, or "in-between."

The Chance F2 Cutout (already accepted and proved in service by 50% of the major utility systems in the country) gives this overall protection throughout its full rating. Gives it because: a fuse link ejector and small bore fuse tube make doubly sure that the cutout operates on low fault currents; its expendable cap, positive contact engagement, and positive latch make certain that it operates on high faults *without damage.*

The F2 Cutout is available from local stocks in voltages of 5.2, 7.8, 15 and 27 KV, and in 100 or 200 amp. ratings with interruption capacities as high as 12,000 amps. You can get the whole F2 story from your Chance salesman, or write us.

A. B. CHANCE CO.
CENTRALIA, MISSOURI
(A. B. Chance Company of Canada, Ltd., Toronto)



. . . it also handles all MEDIUM FAULT CURRENTS

. . . as shown by these test records of the 15 KV F2 Cutout.

2300	13.6 KV	7%
4220	14.1 KV	19%
4380	13.6 KV	7%
4560	13.6 KV	7%

and when HIGH FAULT CURRENTS do occur, the F2 clears them without damage.

These test excerpts show what you can expect from a 15 KV F2 Cutout in the high fault range.

8400	13.6 KV	7%
8630	14.1 KV	13%

CK61-23

engineering; **R. E. Clark** for equipment engineering; **J. K. Loeser** for project engineering; and **J. V. Werme** for electrical engineering.

Whitney Blake Co has appointed **Charles G. Cumpstone** sales manager.

Dane T. Scag has been named assistant director of research in Allis-Chalmers Manufacturing Co's research division.

Francis J. Dunleavy has become general manager, communications and controls division, at Radio Corp of America. **John J. Graham** was named electronic data processing division vice president-operations.
Radio Corp of America has named **R. G. Brooks** as manager, state and local government branch of the electronic data processing division's commercial systems department. RCA picked **Louis H. Wilson** to be manager, western region, for defense electronic products.

General Electric Co has appointed **John F. Hippen** western region manager for the residential market development operation. He succeeded **Frank M. Falge** who retired. The company realigned the communication products department's microwave organization. **Walter E. Sutter** was named manager of the department's microwave systems sales and service. **Al Caldera** became microwave customer services manager and **Wayne E. Evans,** national microwave sales manager in Lynchburg.

General Electric Co has appointed **David W. L. Hickie** marketing manager, Lynchburg operation, rectifier components department.

George A. Bradford became marketing manager for the radio-TV division and was succeeded by **Paul Wassmandsdorf** as GE's advertising and sales promotion consultant. **A. J. Grizzi** was boosted to manufacturing and engineering manager of the conduit products department.

Robert A. Charpie has been appointed manager of advanced developments for Union Carbide Corp. **Curry E. Ford** became development director for National Carbon Co division. He succeeded **Carl A. Odening** who was appointed administrative assistant in the president's office.

G. W. Fugate and **J. William Sanders** have been named assistant sales managers at Central Transformer Corp.

Worthington Corp has named **William A. Meiter** to the newly created post of vice president-Washington services.

Sheldon K. Howard has been named marketing director of the Beloit (Wis.) group of Fairbanks, Morse & Co.

Rockwell-Standard Corp has named **Charles C. Warne Jr** sales assistant to the industrial products group vice president.

David K. Elwell is the new purchases director for Sylvania Electric

Protect the MAIN LINE with

G&W Fused Distribution Centers are an example of the full line of G&W equipment that protects shopping centers all across the country.

Products Inc, subsidiary of General Telephone & Electronics Corp.

Westinghouse Electric Corp has appointed **Edward X. Readings** as graphics coordinator.

OBITUARIES . . . William R. Huntley, 82, retired president of Buffalo General Electric Co, now part of Niagara Mohawk Power Corp . . . **Edward J. Doyle,** 82, former president of Commonwealth Edison Co . . . **Vincent T. Miles,** 57, retired treasurer for Long Island Lighting Co . . . **Dr A. E. Grauer,** 55, chief executive officer and former president of British Columbia Electric Co . . . **O. L. K. McKibben,** 60, treasurer for West Penn Power Co . . . **W. C. Schoeppe,** retired vice president, comptroller and director of Florida Power Corp.

Thomas E. O'Neill Jr, 45, supervisor for Philadelphia Electric Co's service and maintenance division . . . **Stanley Reed Lowery,** auditor for Kentucky Utilities Co.

Douglass Goes to Geneva For Westinghouse Post

R. J. Douglass has been elected president of Westinghouse Electric International, S. A. (WEISA), Geneva. WEISA, subsidiary of Westinghouse Electric Corp, is responsible for the marketing of Westinghouse's products and services outside the western hemisphere.

P. G. Schmitt, former head of the firm, became assistant to the president of Westinghouse Electric International Co in New York.

Douglass was most recently vice president and regional director for Westinghouse Electric Co, S. A., in Buenos Aires, Argentina.

Allis-Chalmers Promotes Clothier and Peterson

Walter L. Peterson has been named to succeed Gordon W. Clothier as motor and generator department manager in Allis-Chalmers Manufacturing Co's industrial equipment division. Clothier was promoted to transformer planning manager for the power equipment division.

Clothier has been motor and generator department manager at the West Allis Works since 1956. Previously he was transformer department manager. Peterson has been assistant manager, motor and generator department, since last year.

Jackson & Moreland Names Taylor as Executive VP

Jackson & Moreland, Inc, Boston consulting engineers, has chosen Arthur Y. Taylor as executive vice president. Taylor has been vice president for testing and laboratory facilities, nuclear and industrial engineering projects since 1958. He has been with the firm since 1945.

G & W Fused Distribution Centers

✻ **Ever had trouble with a branch 4-kv primary tap that blew the whole main feed?**

✻ **Did you ever want to work on a tap and find you had to shut down the whole system before the tap could be isolated and safe to handle?**

G&W Fused Primary Distribution Centers solve these problems completely by providing a fused, three-phase or single-phase disconnecting device that can be operated under load for any tap off the main primary supply. Ideal for protecting primary loops or radial systems operating at voltages up to 15 kv, the G&W Centers can be used indoors or outdoors; are easy to install; and provide a disconnect for safety.

G&W Fused Distribution Centers have proved themselves time and again in applications at shopping plazas, industrial plants, and institutions with one or more buildings but these are only a few of the many places where they can be effective.

Distribution Centers are flexible. One or more circuits can be brought into a center to supply a fused load, or a single supply circuit can be used to feed a fused bus from which multiple load circuits are taken. The main primary feed can terminate in the box or run through as required. Insulated bus pads are provided for each phase leg with no limitation on the number of taps. The box can be bolted onto a concrete pad or embedded four to six inches into the concrete when the pad is poured.

Distribution Centers are gasketed to provide a weatherproof unit that fully meets NEMA Type 3 standards for weatherproof construction. Watertight, submersible construction is also available.

G&W ELECTRIC SPECIALTY COMPANY
3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
Canadian Mfr. • Powerlite Devices, Ltd. • Toronto, Montreal & Vancouver

superior quality standards — inspired specialized design

C61-2

In-Span Damping Cuts Vibration (*Continued from page* 43)

port points usually comply with this requirement. But heavy stabilizing weights, Alcoa found, can do it also.

In the application of the stabilizing weights, the effective span length, *i.e.*, the maximum distance of free travel of a vibration wave, becomes the distance between adjacent stablizing weights, or between a tower and the nearest stabilizing weight. The dissipative load on each damper is thus reduced severalfold.

A nearby reflection point is necessary if the action of dampers is to be analytically predictable. But tests have shown that actual damping can be just as effective without a reflection point, when two dampers are properly spaced with respect to one another far out in the span. Evidently, the damping is at least as effective as that obtained with the stablizing weight system and significantly better at the higher frequencies. But placing a single damper far out in the span has almost no damping effect.

In-span damping installations were tested in a 1,500-ft test span at Massena. Although span length was not great, nor was the span over water, a small enough conductor—No. 2 ACSR, seven strands of aluminum to one steel strand—and a high enough tension, 30% ultimate, produced the long-span effect. On the two parallel spans tested, the maximum amplitude of vibration of each at a point 12 in. from one support point was recorded as a function of vibration frequency.

As the results of this test were similar to those obtained in other tests on 795-MCM ACSR (26 aluminum strands to seven steel) also at 30% ultimate tension, there is support for the conclusion that in-span damping provides a practical approach to the vibration problem in long river crossings.

Non-Shielded Cable Feeds Transformers (*Continued from page* 45)

Coast atmosphere; the Montgomery area for high incidence of electrical storms; and the Birmingham area because of its concentration of heavy industry (steel and chemicals).

Results of the three trial installations were encouraging. The only failure occurred in the Mobile area. Examination indicated that salt deposits prevalent at this particular location lowered the surface resistivity of the cable to a point where excessive leakage occurred, causing heating, tracking and carbonizing of the polyvinylchloride sheath. Because the carbonized path was more conductive than the salt path, heating increased and carbonizing continued until complete flashover occurred.

Trial installations have been discontinued in the salt spray area because of this failure.

Installs Relaying for High Load Densities (*Continued from page* 47)

These relays are removed from service when the circuit breaker is closed and are restored to service about 5 sec later. This is done by the reclosing relays at Kirby Substation. This relay is set for three reclosures in a 60-sec interval, the first being immediate and the other two at 25-sec intervals.

To prevent re-cycling of the reclosing relay and failure to lockout, the last reclosing of the reclosing relay is set 7 sec before lockout position. This allows the instantaneous relays to trip the breaker, should any of them be picked up when restored to service. This provides a definite tripping time for low-current faults which might not operate the very inverse relays, or if so, would do so only after a much longer time.

In substations with underground cable getaways on the feeders, only two reclosures, one immediate and one delayed, can minimize cable damage. Feeders with all-underground cable and radial loads, are closed one time, immediately after the instantaneous trip. The second trip by the induction relays allows coordination with customers' relays and fuses. Underground network feeders with no radial load connected are not closed automatically.

New overhead feeders of 600 MCM all-aluminum were designed for a normal load of 8,000 kva and an emergency rating of 12,000 kva. Some older feeders were conductored with 4/0 copper and 336.4 MCM ACSR. Laterals with conductors as small as No. 4 ACSR or No. 6 copper were tapped to the main lines, as close as 300 ft from the substation. No attempt is made to back-feed to reduce maximum fault currents. Extra-heavy-duty, drop-out fuses, with an 8,000-amp interrupting rating, are used in all high-fault-current areas.

Induction relays on the feeders are set to limit conductor temperature to 300C in an ambient of 40C. No allowance is made for cooling during the open time of the breaker. To meet these conditions, instantaneous elements must be used in the induction relays, so that all trips to lockout will be instantaneous for the higher values of fault currents. A setting of about 4,800 amp on these elements allows the largest fuse link on the Houston system to blow within the operating time of the station breaker.

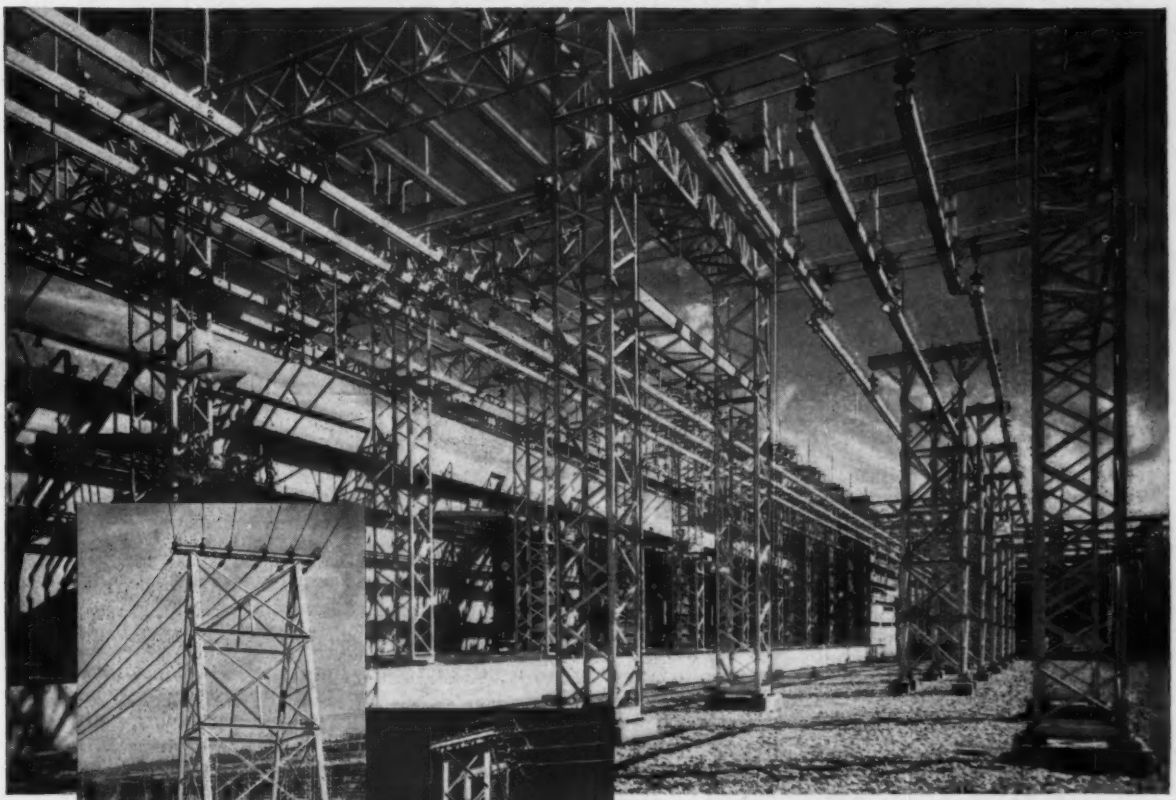
Small-conductor laterals tapped from the main feeders are fused so that conductor temperature will not exceed 300C before the fuse blows. In the higher load density areas, where feeders are short and fault currents high over the entire feeder, it is impossible to fuse laterals with links which will last through the instantaneous trip of the circuit breaker and still protect the smaller conductor sizes. But in these areas, laterals are short and blown sectionalizing fuses not numerous, even without the instantaneous trip and reclosure scheme. Nevertheless, a considerable benefit is obtained from the instantaneous trip in clearing temporary faults and flashovers on the main line before excessive burning.

REYNOLDS ALUMINUM "custom tailors" substations to lower your costs

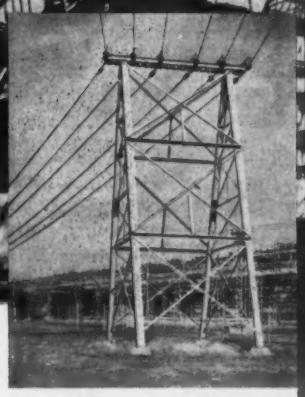
At Phoenix, Arizona, Reynolds Structural Fabricating Division is designing, fabricating and assembling structures in lightweight aluminum from the ground up, rather than merely substituting aluminum in conventional designs. Aluminum's light weight facilitates fabrication and assembly. And the strength plus light weight advantage of aluminum extrusions permit a 60 to 70% reduction in structure weight while retaining load-carrying capacities of structures made of heavier materials. The result: savings in metal, savings in weight, savings in shipping, handling, and erection costs.

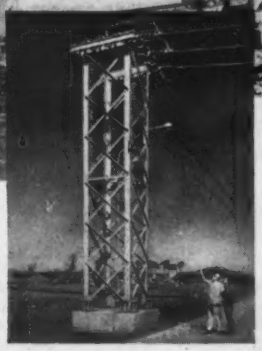
Aluminum substations require an absolute minimum of maintenance. Aluminum never rusts. Periodic protective painting that over a period of years can cost more than the original structure is not necessary with aluminum. Also with aluminum, there's no problem of painting "hot" structures or costly shutdowns for maintenance. Corrosion-resistant aluminum structures are ideal for seacoast and industrial areas.

Reynolds can offer a complete series of standard aluminum structural shapes or design new shapes to fit your requirements. For complete information on aluminum substations that will deliver longer service at a lower per year cost, write *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*



Light, bright aluminum substations not only look good, but *stay new looking* without expensive maintenance.





Various structural units for substations and switchyards can be built with standard aluminum structurals or structurals designed to meet specific requirements. In either case, prefabrication and assembly mean lower handling and erection costs.

Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV

13-58

Low Cost Computer for Power Stations

A sophisticated low-priced control computer with capabilities ranging from simple logging to closed-loop control, the TRW-330 brings you a new standard in flexibility. You can start with a small basic system that matches your current requirements and then add capabilities as you need them.

Thompson Ramo Wooldridge has successfully installed more digital control computers than any other manufacturer. Because TRW-330 design is based on this experience, you are assured that a TRW-330 system offers the greatest value per dollar in computer hardware – in flexibility, reliability, efficiency.

TRW-330 FLEXIBILITY – Memory sizes range from 4,000 to over 100,000 words; analog input capacity from 0 to over 1,000; an optional subsystem permits automatic scanning and alarm functions to proceed independently of the computer's control program. A similar degree of flexibility is afforded by the TRW-330's analog-output system, priority interrupt circuits, digital input-output equipment, fast-access storage, and command structure.

TRW-330's are supplied in cabinets that match the application: rugged cabinets for harsh industrial environment, air purgable cabinets for hazardous environment, or standard control-room cabinets.

TRW-330 CAPABILITIES – TRW-330 computing speeds exceed those of competitively priced machines; addition instructions can be performed in 260 microseconds, including access time.

TRW Computers Company

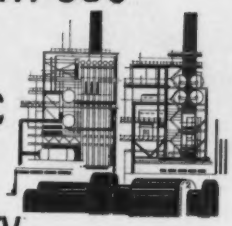
a division of **Thompson Ramo Wooldridge Inc.**

TO FIND OUT HOW THE TRW-330 CAN BE APPLIED TO YOUR CONTROL PROBLEM, CONTACT ANY OF THE TRW COMPUTERS COMPANY OFFICES LISTED BELOW.

220 North Canon Drive	1510 Esperson Building	200 East 42nd Street	200 South Michigan Avenue	3272 Peachtree Road, N.E.
BEVERLY HILLS, CALIFORNIA	HOUSTON, TEXAS	NEW YORK 17, NEW YORK	CHICAGO, ILLINOIS	ATLANTA 5, GEORGIA

The TRW-330 in the electric power industry

13-68



TRW computer systems are accepted by the industry: 2,000 megawatts will soon be controlled by Thompson Ramo Wooldridge systems. In all, nine TRW computer systems are being supplied to the electric power industry in the U. S. and abroad.

The largest installation will be the TVA Paradise Station near Drakesboro, Kentucky. Two TRW-330's will control two 650-megawatt generating units. Each computer will control its generating unit through startup, operation, and shut down. The TRW-330's will perform sequencing operations and sequence monitoring, make performance calculations, log data, perform sensor scanning and alarm monitoring, and will supply signals for trend recording.

For electric generating units in the 25 to 100 megawatt range Thompson Ramo Wooldridge has developed a standard-package digital computer control system called MULE—for Medium Utility Logger-Economizer. Using the TRW-330, the MULE system takes advantage of standardized project engineering and computer programming to keep costs within the reach of the medium-sized utilities.

The experience of Thompson Ramo Wooldridge is your guarantee in both hardware and systems engineering. Investigate the TRW-330 in the light of your own requirements today.

TRW Computers Company

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Selling

Finishing Plant Has Heat Pumps

The new 140,000-sq-ft Masland Duraleather Co finishing plant in Mocksville, N. C., is reportedly the largest industrial plant in the South to be entirely heated and cooled by heat pumps.

Albert C. McCoy, president of Masland, said a reduction in operating cost was a major factor in selecting a heat pump to heat and cool the plant, rather than the more conventional two-part system of a boiler for heating and a refrigerating machine for cooling.

He also said while the initial cost of the two kinds of equipment was about the same, "it is anticipated that the annual operating cost for the heat pump will be about $5,500 compared to $10,000 for the conventional system."

The heat pump, reported to be the first centrifugal heat pump using outside air as a source of heat, will maintain conditions of 80 deg and 50% relative humidity in summer, and 72 deg in winter.

The new system consists of two electrically driven centrifugal chillers. The larger unit has a cooling capacity of 200 tons; the other provides 80 tons of cooling capacity.

The entire facility was designed and engineered for Masland by William F. Lotz, Philadelphia engineering and construction firm, who also supervised all construction operations. Valley Engineering Co served as associate to Lotz in the design of the heat pump system.

SELLING BRIEFS

Tallest total-electric apartment building in New England was constructed this spring in Springfield, Mass. Western Massachusetts Electric Co estimates 173-apartment structure will use as much electricity as 160 total-electric homes. Approaches to the building will be electrically heated for continuous ice and snow removal; quartz-lamps will warm the passageway from parking area to the building.

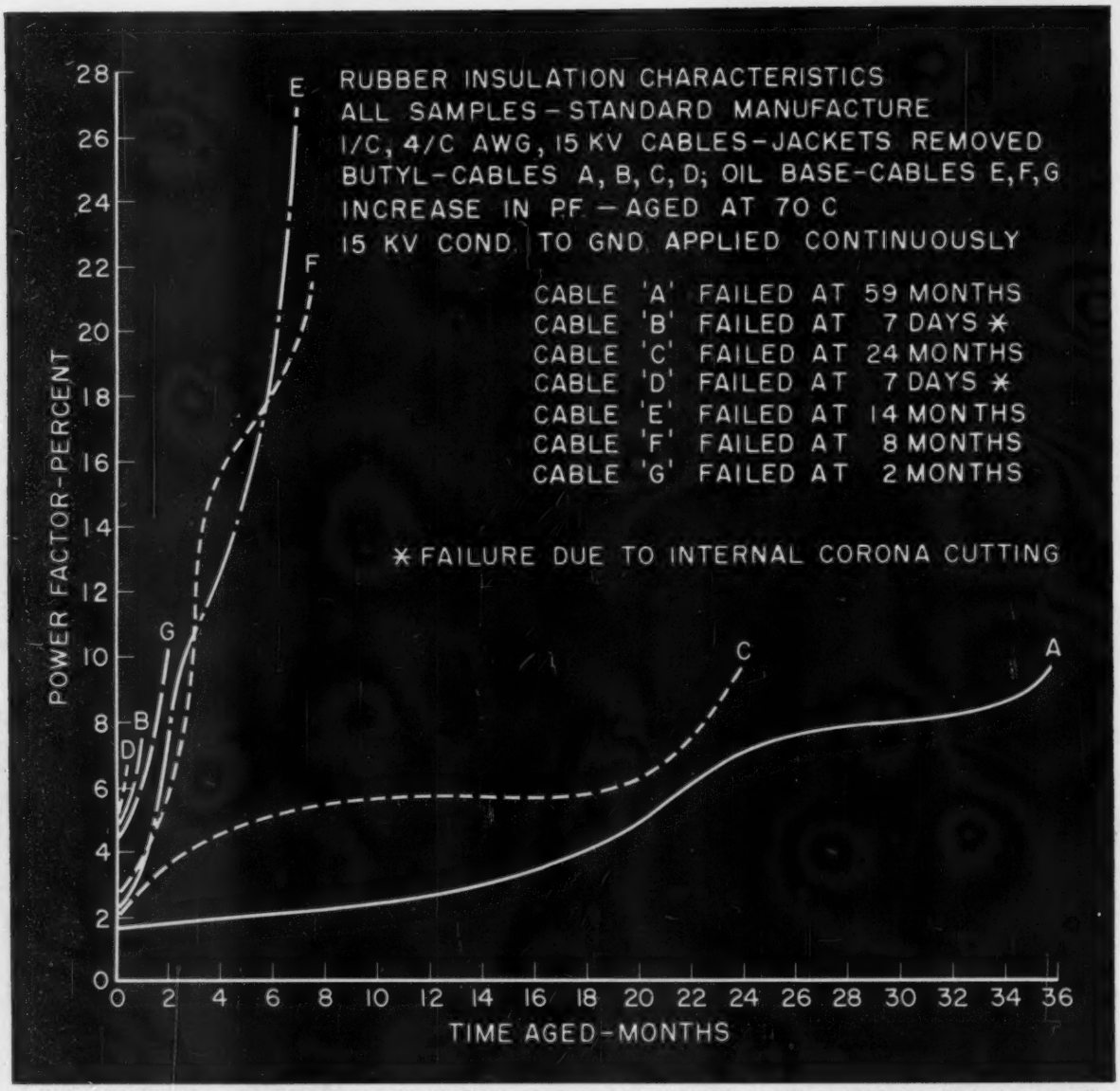
The 200-amp entrance panel promotion program run by the Klickitat County PUD has added 6,213 kw and created $254,745 worth of business for electrical contractors and dealers since its inception in 1958. The PUD has issued 472 panels free to residential customers who add at least one major electrical appliance or who rewire their homes. Cost to the PUD for the panels and materials was $25,960, as compared to an annual increase of $43,000 in gross revenue. Some customers have added appliances in addition to those for which they obtained the entrance panel.

Duke Power Co has expanded its Housepower Panel Plan to include residential customers requiring up to 400-amp service entrances. Extension was made possible because of the larger size panels now available from manufacturers.

Build First Automatic Coal-Fired Unit (*Continued from page* 42)

should outweigh the disadvantages. SPARC systems will come into their own when they have been made sufficiently reliable so that manual controls and control rooms can be left out of the design. This step should come in a few years.

CP&L will not install any other SPARC system until that at Goldsboro has been placed in operation, de-bugged, and its benefits proved. The MARC system at Robinson has given greater benefits than were originally estimated. These benefits outweigh the costs, although at the time the company decided to put in the system, this relationship was doubtful. The SPARC system is expected to prove itself and become a common feature of power plants.


RUBBER INSULATION CHARACTERISTICS
ALL SAMPLES - STANDARD MANUFACTURE
1/C, 4/C AWG, 15 KV CABLES - JACKETS REMOVED
BUTYL - CABLES A, B, C, D; OIL BASE - CABLES E, F, G
INCREASE IN P.F. - AGED AT 70 C
15 KV COND. TO GND. APPLIED CONTINUOUSLY
CABLE 'A' FAILED AT 59 MONTHS
CABLE 'B' FAILED AT 7 DAYS *
CABLE 'C' FAILED AT 24 MONTHS
CABLE 'D' FAILED AT 7 DAYS *
CABLE 'E' FAILED AT 14 MONTHS
CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
POWER FACTOR-PERCENT
TIME AGED-MONTHS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
A
B
C
D
E
F
G

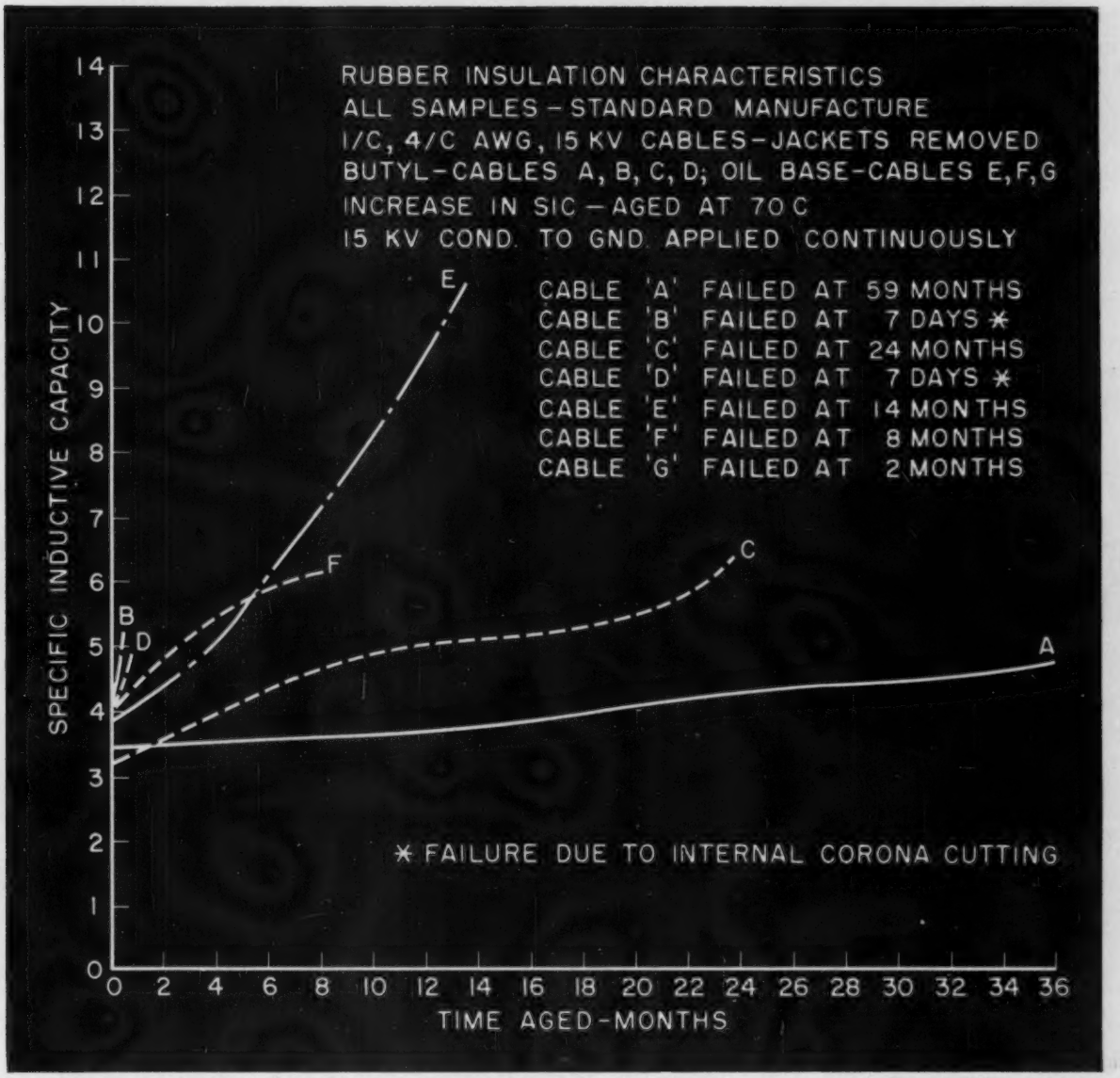
DURASHEATH LASTED TWICE AS LONG AS NEXT-BEST RUBBER CABLE. Cables were submerged in water heated to 70C, and 15000 volts conductor-to-ground applied

Anaconda

These accelerated-life tests prove

Anaconda proved the big difference in rubber insulations by buying competitive cables on the open market, taking a random sample of an Anaconda Durasheath cable out of stock, and running them all through a five-year *underwater test at 173% RATED VOLTAGE.* This extra-rugged non-standard test comes closer, on an accelerated basis, to correlating cable performance under actual operating conditions than any industry test. As you can see, Anaconda Durasheath ("A" in the chart) lasted more than twice as long as the next-best cable—59 months compared to 24 months.

Durasheath quality is the result of three factors: Superior compounds resulting from years of developmental research and constant improvement; advanced techniques of manufacture; and better ingredients. For instance, Anaconda Butyl (AB) insulation is compounded with only nonhygro-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INCREASE IN SIC - AGED AT 70 C
15 KV COND. TO GND. APPLIED CONTINUOUSLY
CABLE 'A' FAILED AT 59 MONTHS
CABLE 'B' FAILED AT 7 DAYS *
CABLE 'C' FAILED AT 24 MONTHS
CABLE 'D' FAILED AT 7 DAYS *
CABLE 'E' FAILED AT 14 MONTHS
CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
SPECIFIC INDUCTIVE CAPACITY
TIME AGED - MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
A
B
C
D
E
F

continuously. Where other cables had failed completely, Durasheath's power factor (line A, left) had increased from 1.5 to only 7.1; SIC (line A, right) from 3.5 to 4.3.

proves it!

there is a difference in rubber insulations

scopic fillers to prevent increase in power factor by moisture absorption.

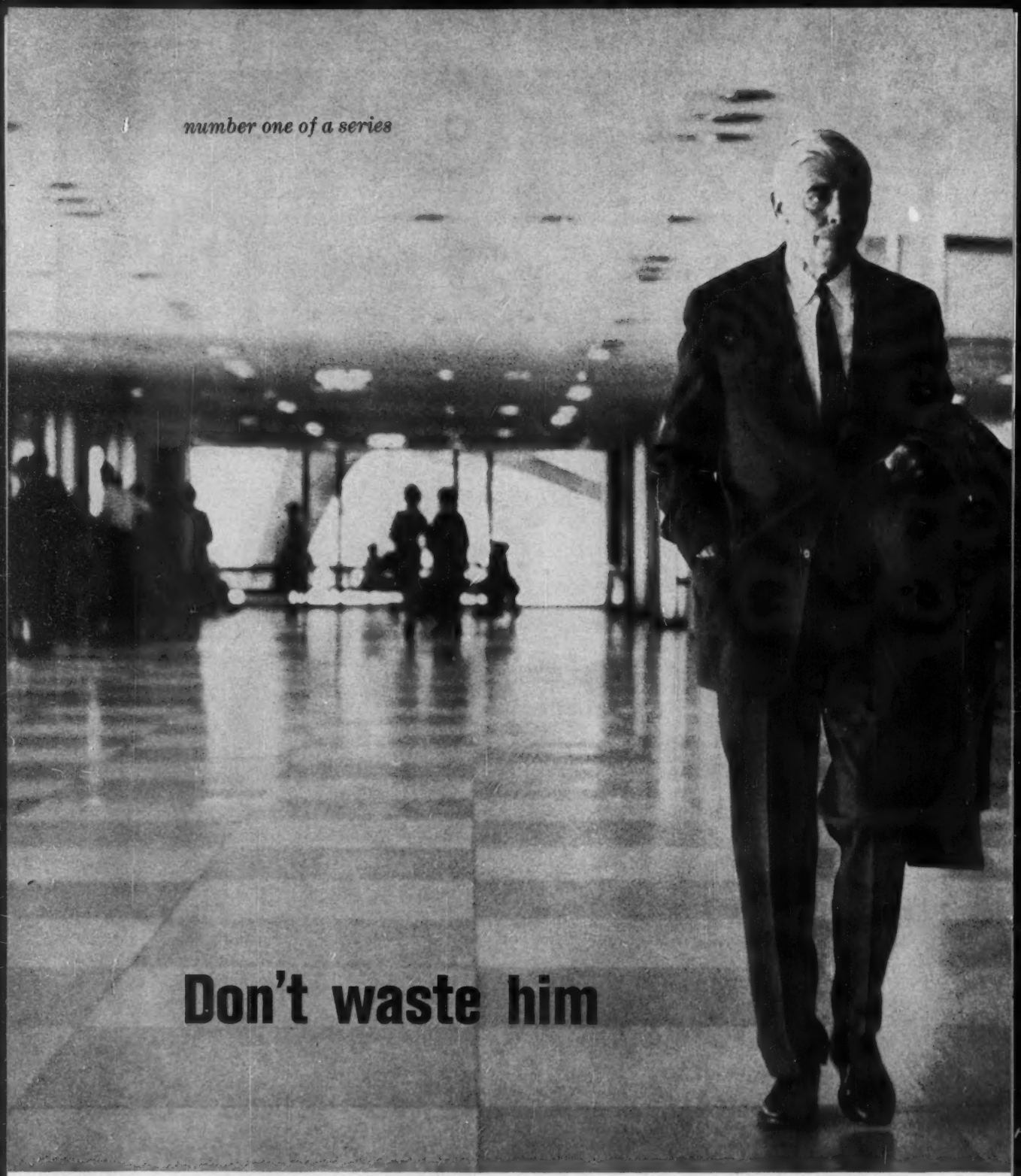
Durasheath's superiority is now further improved by a uniquely new "Uniblend" mixing process which literally homogenizes the Butyl mixture, disperses all the components thoroughly to prevent variations in the high dielectric strength of Anaconda Butyl (AB) insulation.

For more facts on Durasheath and Anaconda's new Uniblend mixing process, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-2-EW. 61249

ASK THE MAN FROM

ANACONDA®

FOR DURASHEATH BUTYL-INSULATED CABLE



He costs you $20,000 a year*, and carries the responsibility for selling your major prospects. Now he's keeping an important appointment. He's done his planning. He's primed for this interview. And he can draw on years of selling experience in his field.

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The men with responsibility for equipment purchase are looking for facts. Their jobs depend on them. You help them when your ads spell out the details on your company and its products. And you help your salesman,

**based on averages for salary and expenses estimated by American Salesman Magazine*

who can then concentrate on proposals and personalities —the difficult selling jobs that *only* he can handle.

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Electrical World

the electrical industry's weekly magazine

Small Gas Turbine Concept Questioned

Electrical World's inquiry several weeks ago (EW, July 31, p 28) into electric utilities' plans for meeting natural gas "do-it-yourself" competition revealed considerable interest. Some of the companies contacted went one step further and raised questions concerning the practicality of small gas turbine-generator units.

Typical of the questions and criticisms of the concept in the minds of electrical industry people are these raised by Texas Electric Service Co. In order to show the precise answers offered by natural gas interests, an *Electrical World* reporter carried the questions to Northern Illinois Gas Co and compiled the following question and answer report.

Texas Electric: "The gas turbine is essentially a high-speed machine requiring expensive gear reducers to drive conventional generators, pumps, compressors, etc."

NI Gas: "The only equipment to be driven in the NI Gas energy package concept are high-speed, high-frequency generators. At the moment, these will require gear reductions of five to one: from 40,000 turbine rpm to 8,000 generator rpm. In the future, we hope to have direct-drive generators."

Texas Electric: "The gas turbine is very noisy in operation. The problem of noise suppression is a very real one, and is a deterrent to the use of a gas turbine unless expensive equipment is provided to suppress exhaust noise."

NI Gas: "High-frequency noise, like that coming from turbines, is highly directional; it can be reduced with readily available equipment. In the NI Gas system, we will put a 90-deg bend in the intake duct (which is the source of maximum noise) and use sound-reducing baffles within the duct. We will pass turbine exhaust gases through boilers which will both reduce noise and generate steam. All intake and exhaust ducts will point straight upwards; noise still passing through the system will be directed toward the sky. This sound-reducing equipment is not expensive. The power room ceiling and walls will be covered with regular acoustical tile; its floor will be covered with a fiber mat. In addition, the power room will be below ground level. There will not be a noise problem of any kind in this installation."

Texas Electric: "The gas turbine requires an outside source of starting power. A turbine isn't something that the janitor or handy man can start and operate; it requires skilled labor."

NI Gas: "A button, a 12-v battery, a truck engine starter, and one finger will start our turbines. Operation is completely automatic."

Texas Electric: "Turbines burning natural gas taken directly from pipelines may need an extra gas compressor, boosting pipeline pressure by five or ten to one."

NI Gas: "Our first installation will use gas from a high-pressure, 150-psi pipeline; it will not require any compressor. We realize, however, that this is a convenient situation which will not occur at every other installation. The American Gas Assn is sponsoring a project with a turbine manufacturer to develop an on-shaft compressor. Other turbine manufacturers understand this problem and are working along similar lines. At the very most, this on-shaft gas compressor will not require more than 6% of the turbine power to drive it. The development of on-shaft gas compressors, conservatively speaking, is only several years away. Even without on-shaft compressors, however, there are several other gas compressors available now which will do an equivalent job."

Texas Electric: "Turbine manufacturers making packaged prime movers and waste heat boilers must provide a warranty and service policy. Building owners will need to know the costs of service contracts, the inspection routines, and the down-time required."

NI Gas: "Yes, this is true; the turbine manufacturer will provide a warranty. This, together with the respective gas utility, will provide an effective service policy. This is the usual practice with most mechanical equipment suppliers. As far as down-time is concerned, the concept provides stand-by equipment. The chance of a 100% failure in all turbine system components is less likely than the usual electrical utility outage."

Texas Electric: "Because turbines operate at high speeds, it is practical to generate high-frequency electricity with them. There are benefits to be had from high-frequency fluorescent lighting, but it is not necessary to use turbines to obtain these benefits."

NI Gas: "This is true. But since, for the average department store, school, office building, etc., approximately 60 to 75% of the electrical power requirement is for lighting, it would be cheaper to produce high-frequency power and convert only the remaining 25 to 40% to 60 cps. Conversion of 60-cps power by means of a motor-generator or solid state unit up to 400-cps power is more expensive than conversion of 400-cps power down to 60-cps if the power requirements are considered. Comparing relative costs of purchased 60-cps power and high-frequency power from turbine-generators, we believe the operating cost differential to be at least 25% in favor of turbines if the bonus of heating and cooling is included."

Texas Electric: "Although exhaust heat can be used to make steam, there must be some balance between electrical generation and heating and cooling requirements. This balance is rarely found in practice."

NI Gas: "Using only two turbine-generator units (one acting as a stand-by), this statement is true. This is why NI Gas advocates the multiple package concept. For example: using four units, one acting as a stand-by, we have three units and each will provide one-third of the load. Thus, we concern ourselves with only one-third of the load-balancing problem. If we have high demand for steam and low demand for electrical power, we operate one turbine-generator-boiler package and use an auxiliary burner to fire a second or third boiler. The usual load balancing problem affects steam demand. It is not necessary to run a turbine just to generate steam. Using a separate burner on the boiler, steam can be produced and not electricity."

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The City of Lakeland, Florida, Department of Electric and Water Utilities, is accepting applications for position of Utilities Engineer. Applicants must have degree in electrical engineering; registered or capable of being registered in State of Florida. At least five years experience in supervisory or technical staff responsibilities in private or public utility plant. At least ten years experience in engineering capacities of design and programming nature. Excellent opportunity. Salary $10,000 to $12,000. Retirement, leave and insurance benefits. Contact Emory E. Walker, Personnel Director, Civil Service Office, City Hall, Lakeland, Florida, or C. D. McIntosh, Jr., Director of Department of Electric and Water Utilities, City Hall, Lakeland, Florida.

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Permanent openings for Resident Engineers experienced in supervision of construction of large steam power plants and/or high-voltage transmission lines. Degree and registration desirable. Excellent opportunity with consulting engineering firm. Please send resume of education and experience and salary requirements to P-7230, Electrical World.

INDUSTRIAL ENGINEER
The City of Lakeland, Florida, Department of Electric and Water Utilities, is accepting applications for position of Industrial Engineer. Applicants must have degree in mechanical, electrical or industrial engineering, with at least five years supervisory or staff experience in public or private utility plant. Approximately ten years experience in various phases of industrial engineering. Excellent opportunity. Salary $10,000 to $12,000. Retirement, leave and insurance benefits. Contact Emory E. Walker, Personnel Director, Civil Service Office, City Hall, Lakeland, Florida, or C. D. McIntosh, Jr., Director of Department of Electric and Water Utilities, City Hall, Lakeland, Florida.

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U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5653) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, September 28, 1961, for furnishing three, 39,000/52,000/65,000-kva, 230 grdY to 13.2-Kv., single-phase, power transformers for Spring Creek Powerplant, Central Valley Project, California. Delivery is desired within 365 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. Floyd E. Dominy, Commissioner.

Shawinigan to Build Power-Chemical Complex

Shawinigan Chemical Co, a wholly-owned subsidiary of Shawinigan Water & Power Co, has announced plans for a $110-million petrochemical and power complex at Varennes, on the south shore of the St. Lawrence River near Montreal.

A $20-million petrochemical plant is scheduled for operation by mid-1963, and a $45-million, 300-Mw steam generating station will be built by Shawinigan Water & Power at Tracey, near Sorel, Quebec. The first 150-Mw unit of the steam station will be in operation by mid-1964. Supplemental power will be generated at a $45-million hydroelectric project at Rapids des Coeurs.

The British American Oil Co will process crude oil to provide raw materials for the plant. At the same time, heavy fuel will be processed by the chemical facility as a byproduct for use in the steam station as boiler fuel.

Integration of the petrochemical project with the thermal power station offers advantages to both. Economic success of the petrochemical plant depends to a considerable extent on the ability to dispose of the residual fuel oil produced in the processing of the crude oil. The steam plant will provide this market while having an assured supply of fuel.

The chemical plant will produce ethylene, propylene and other products basic to the chemical industry.

Letters (*Continued from page 5*)

ment under any circumstances, even where the lack of federal development means economic waste. This is not a sensible position and does no credit to the magazine nor to that segment of the industry for which it appears to be a spokesman.

Alex Radin, General Manager
American Public Power Assn

► *Electrical World's* policy on federal power is well-known. Definitively, we have said (Oct. 31, 1960, p 45): "The federal government should not be in the power business. The necessity and desirability of multi-purpose stream development is undeniable, and often the federal government is the only agency capable of such development. But power facilities, accruing therefrom, should be installed and operated by others . . ."

Where a federal development, designed basically for non-power purposes, is proved by rational economic (or defense) standards to be beneficial, and where rational economic standards prove that power should be developed as a by-product, we would not oppose such development. We would prefer to see others than the federal government develop the power features, with (continuing from the Oct. 31, 1960, editorial) "compensation being paid to the government at a rate commensurate with benefits (to help) defray the non-power costs . . ." This assumes the determination of the benefits also is in accordance with the rational economic standards.

The NPR is a case in point. We did not oppose its original construction, for its prime purpose was to produce weapons-grade plutonium—a function completely out of our field, and out of yours. We *do* oppose the development of the by-product heat as power. We have set forth many reasons recently. But as regards the "economic waste" point you raise, we submit that rational economic analysis shows that, rather than the *non*-development of this power being "waste," the opposite is true. The energy being "wasted" down the Columbia River is very low-grade (we suggest a trip to your thermodynamics textbook). Simply, it would cost more to utilize it than to develop the same amount by alternative means.

Even in the best steam plants (including TVA's), roughly 60% of the fuel's energy is "wasted" into the cooling water and the atmosphere. Yet no one sheds tears about "economic waste." Yet again: Would you be willing to spend, say $10,000 for a $3,000 car if then it would "waste" only 70% of the gasoline's heat to the atmosphere instead of about 80%? No. You have better uses for that additional $7,000.

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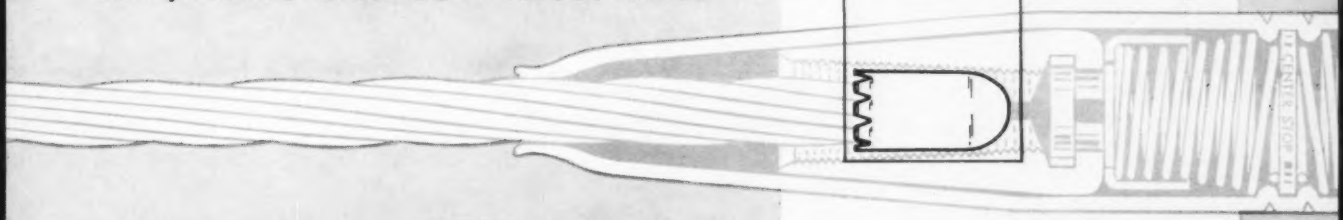

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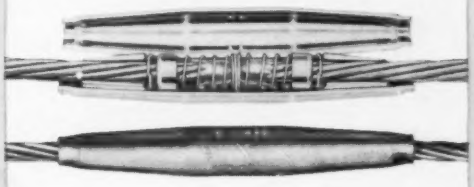

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AL5547	4	5
AL5527	2	3
AL55101	1	2
AL55107	1/0	1
AL55207	2/0	1/0
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AL55407	4/0	3/0
AL55266.8	266.8	4/0

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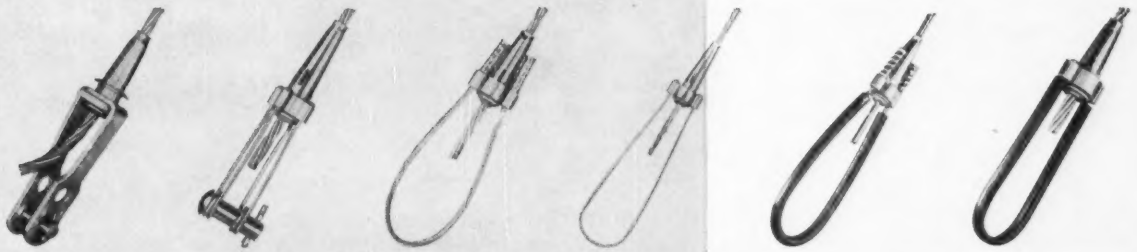

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